

101.1115-4520-208-15

# TM 5-4520-208-15

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

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RETURN TO GOV. DOCS. OFFICE

OPERATOR, ORGANIZATIONAL, DIRECT AND GENERAL  
SUPPORT AND DEPOT MAINTENANCE MANUAL FOR  
HEATER, DUCT TYPE, PORTABLE

400,000 BTU/HR

MODELS BT400-40 AND BT400-40-1

FSN 4520-792-8257 AND FSN 4520-930-9474

This copy is a reprint which includes current  
pages from Changes 4 through 8.

HEADQUARTERS, DEPARTMENT OF THE ARMY

MARCH 1967

## **SAFETY PRECAUTIONS**

Do not operate heater in fuel areas or areas lacking adequate ventilation to support heater fuel combustion.

When filling fuel tank, do not smoke or use open flame in the vicinity. Always provide metal-to-metal contact between fuel container and fuel tank to prevent spark from being generated as gasoline flows over metallic surfaces.

Do not operate heater inside a building.

Remove air outlet cover from air discharge end of heater before operating heater. Air inlet door must be open when heater is operating.

Maximum permissible towed speed for the heater is 20 mph over smooth paved surfaces.

Extinguisher, fire, carbon dioxide, should be available on a stand-by basis within the operating perimeter of this heater.

Change }  
No. 4 }

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
Washington, D. C., 28 October 1970

**Operator, Organizational, Direct and General Support and  
Depot Maintenance Manual  
HEATER, DUCT TYPE, PORTABLE; 400,000 BTU/HR  
(AMERICAN AIR FILTER MODELS)  
(MODEL BT400-40) FSN 4520-792-8257  
(MODEL BT400-40-1) FSN 4520-915-7789**

TM 5-4520-208-15, 20 March 1967, is changed as follows:

*Cover Page and Table of Contents Page.* The title is changed to read as shown above.

*Page 1.* Paragraph 1e is superseded as follows:

e. The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028, Recommended Changes to DA Publications, and forwarded direct to the Commanding General, U.S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Boulevard, St. Louis, Mo. 63120.

*Page 8, paragraph 6b (1).* In line 3, FSN "4520-930-9474" is changed to read "4520-915-7789."

*Page 16.* After paragraph 12, paragraph 12.1 is added as follows:

**12-1. Engine Crankshaft, Fan Shaft, and Heat Exchanger Alinement**

- a. Remove engine (para 12b (1)).
- b. Remove drive coupling (15, fig. 24) from crankshaft of engine using a suitable puller.
- c. Remove rubber bushing (2, fig. 25) from coupling half (30).
- d. Remove V-belt (29).
- e. Remove coupling half (30) from fan shaft bearing using a suitable puller.
- f. Install engine on heater and secure with three thumbscrews.
- g. Loosen the four heat exchanger mounting bolts (30, fig. 49) and move heat exchanger from

side to side until engine crankshaft and fan shaft are horizontally aligned. This alignment can be checked with a straight edge. When alinement is achieved, tighten heat exchanger mounting bolts securely.

h. Loosen the four bolts (16, fig. 24) that secure engine to engine mounting bracket. Move front of engine up or down until engine crankshaft is vertically alined with the fan shaft. This alinement can be checked with a straight edge. Tighten mounting bracket bolts after alining shaft.

i. Remove vaneaxial fan and mounting ring assembly (para 77b (3) and (4)).

j. Install coupling half on fan shaft bearing and rubber coupling in coupling half.

**CAUTION**

To prevent damage to fan, place suitable support under shaft bearing before installing coupling half.

k. Install vaneaxial fan and mounting ring assembly on heater.

l. Install drive coupling on engine crankshaft. Refer to paragraph 12a, through c and install engine.

*Page 18, paragraph 19a.* In line 3 "by-passing" is changed to read "by by-passing the". In line 4 "Contorl" is changed to read "Control".

*Page 19, paragraph 20a.* In line 4 and line 5, delete "selector valve knob."

\*Change no. 4 supersedes Changes no. C1 18 Apr 68, 62 10 Apr 69, and C3 4 Nov 69.

Page 21, paragraph 29c. In line 7 "fuel" is changed to read "full."

Page 23. Paragraph 33d is added after paragraph 33c (7) as follows:

*d. Emergency Stopping of the Heater:*

(1) In case of fuel control valve failure only, turn the temperature selector valve knob counter-clockwise until the pointer on the temperature selector indicator knob is in the lowest position.

(2) Open the damper control (fig. 13).

(3) Operate the engine (or electric motor) until the discharge temperature gage (fig. 11) indicates a reading of 150° F. or less.

(4) Open the access door on top of the cabinet and place the stop switch on the engine (or electric motor) in the OFF position.

**NOTE**

Do not operate a heater after using the above procedure until the fuel control valve has been replaced.

Page 24, paragraph 35b (1). In line 1, "Charge" is changed to read "Change."

Page 26, paragraph 36d. In line 3 "TM 5-2805-208-14" is changed to read "TM 5-2805-256-14."

Page 27, paragraph 41a. Delete "The lubrication chart for the Model 1A08-III Military Standard Engine is contained in TM 5-2805-208-14."

Page 27, paragraph 42d. In line 2 "TM 5-2805-208-14" is changed to read "TM 5-2805-256-14."

Page 31, figure 18 (1), item 2. In line 1 " $\frac{1}{4}$  of  $\frac{1}{2}$ " is changed to read " $\frac{1}{4}$  to  $\frac{1}{2}$ ."

Page 33, figure 19 (1), item 1. In line 1 "TM 5-2805-208-14" is changed to read "TM 5-2805-256-14."

Page 34, figure 19 (2). Item 3 is changed to read "FUEL PUMP". Inspect fuel pump for damaged strainer, loose connections, secure mountings, cracks, breaks, or leaks. Clean or replace a defective fuel pump."

Page 35, figure 19 (3), item 14. In line 2 "Replace" is changed to read "Inspect" and after last line add "Clean. Replace a defective element."

Page 36, paragraph 46b. In line 1 "TM 5-2805-208-14" is changed to read "TM 5-2805-256-14."

Page 37, paragraph 49. In line 1 "TM 5-2805-208-14" is changed to read "TM 5-2805-256-14."

Page 37, paragraph 51. In line 1 "TM 5-2805-208-14" is changed to read "TM 5-2805-256-14."

Page 38. Paragraph 64.1 is added after paragraph 64 as follows:

## 64-1. Excessive Failure of Rubber Coupling

*Probable cause*

Engine crankshaft and fanshaft not alined.

*Possible remedy*

Aline crankshaft and fanshaft (para 12.1).

Page 41, paragraph 71. In lines 3 and 4 "TM 5-2805-208-14" is changed to read "TM 5-2805-256-14."

Page 55. Paragraph 88 is superseded as follows:

## 88. Heater Fuel Filter

*a. General.* The following procedure will be used when replacing the throw-away filter, used on the 400-40 heater, with the cleanable type fuel filter (used on the BT400-40-1).

*b. Removal.*

(1) Remove the power unit (para 12).

(2) Remove the filter to pump metal hose assembly (50, fig. 34) from the fuel filter (47).

(3) Remove the fuel filter from the tee in fuel tank (47, fig. 34).

(4) Remove the fuel tank (para 85d (4)).

(5) Remove plug from top of fuel pump and elbow from bottom of pump.

**NOTE**

These two items will be reinstalled on the fuel pump in opposite positions.

*c. Cleaning and Inspection.* Refer to paragraph 93 for cleaning, inspection, and servicing the cleanable type fuel filter.

*d. Installation.*

(1) Install plug in bottom of the pump and elbow in top of pump.

(2) Install reducer (60, fig. 37) on elbow located in top of pump.

(3) Install the elbow in the inlet side of the cleanable type fuel filter.

(4) Install the fuel filter (outlet side) on the reducer in top of the fuel pump.

(5) Install the hose (47, figure 37) to elbow (48) in inlet side of fuel filter.

(6) Install the fuel pump (para 85f).

(7) Connect hose assembly (filter to tank) to elbow in tank.

(8) Install the power unit (para 12).

Page 76, paragraph 108b (3). In lines 2 and 3, delete "and plain encased seal (14)."

Page 85, paragraph 121f. In line 8 "TM 5-2805-208-14" is changed to read "TM 5-2805-256-14."

Page 87, paragraph 128b. In line 2 "TM 5-2805-208-14" is changed to read "TM 5-2805-256-14."

Page 89, paragraph 133. In line 3 "TM 5-2805-208-



14" is changed to read TM 5-2805-256-14."

Page 97. "Note" is added after paragraph 155c as follows:

#### NOTE

Apply an approved type lubricating oil to inside surface of fuel pump and all internal components if it is anticipated that the heater will not be operated for thirty (30) days or more.

Page 107, paragraph A-3. In line 4 "TM 5-2805-208-14", Organizational, DS and GS Maintenance Manual (Including Repair Parts and Special Tools List), Engine, Gasoline, Military Standard Model 1A08-III, 1½ HP, FSN 2805-068-7510 and Model

2A016-III, 3 HP, FSN 2805-072-4871" is changed to read "TM 5-2805-256-14. Operator's, Organizational, DS and GS Maintenance Manual, Engine, Gasoline, 1½ HP, Military Standard Models 1A08-I, FSN 2805-601-5181, Model 1A08-2, FSN 2805-714-8552 and Model 1A08-3, FSN 2805-068-7510".

Page 107, paragraph A-5. Add "TM 5-2805-256-24P, Organizational, Direct and General Support Maintenance Repair Parts for Engine, Gasoline, 1½ HP, Military Standard Models 1A08-1, FSN 2805-601-5181, 1A08-2, FSN 2805-714-8552 and 1A08-3, FSN 2805-068-7510".

Page 109, Appendix II. Maintenance Allocation Chart is superseded as follows:

## APPENDIX II MAINTENANCE ALLOCATION CHART

### Section I. INTRODUCTION

#### 1. General

a. This section provides a general explanation of all maintenance and repair functions authorized as various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions of the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. No special tools and test equipment required for maintenance functions.

d. Section III contains supplemental instructions, explanatory notes and/or illustrations required for a particular maintenance function.

#### 2. Explanation of Columns in Section II

a. *Group Number, Column (1).* The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes (obtained from TB 750-93-1, Functional Grouping Codes) are listed on the MAC in the appropriate numerical sequence. These indexes normally are set up in accordance with their function and proximity to each other.

b. *Functional Group, Column (2).* This column contains a brief description of the components of each functional group.

c. *Maintenance Functions, Column (3).* This column lists the various maintenance functions (A through K) and indicates the lowest maintenance category authorized to perform these functions. The symbol designations for the various maintenance categories are as follows:

- C — Operator or crew
- O — Organizational maintenance
- F — Direct support maintenance
- H — General support maintenance
- D — Depot maintenance

The maintenance functions are defined as follows:  
A — INSPECT. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

B — TEST. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

C — SERVICE. To clean, to preserve, to change, to paint, and to add fuel, lubricants, cooling agents, and air.

D — ADJUST. To rectify to the extent necessary to bring into proper operating range.

E — ALINE. To adjust specified variable elements of an item to bring to optimum performance.

F — CALIBRATE. To determine the corrections to be made in the readings of instruments or test

equipment used in precise measurement. Consists of the comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

G — INSTALL. To set up for use in an operational environment such as an emplacement, site, or vehicle.

H — REPLACE. To replace unserviceable items with serviceable assemblies, subassemblies, or parts.

I — REPAIR. To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

J — OVERHAUL. Normally, the highest degree of maintenance performed by the Army in order to minimize time work in process is consistent with quality and economy of operation. It consists of that maintenance necessary to restore an item to completely serviceable condition as prescribed by maintenance standards in technical publications for each item of equipment. Over-

haul normally does not return an item to like new, zero mileage, or zero hour condition.

K — REBUILD. To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.

d. *Remarks, Column (4).* This column is provided for referencing by code the remarks (Sec III.) pertinent to the maintenance functions.

### 3. Explanation of Columns in Section III

a. *Reference Code.* This column consists of two letters separated by a dash, both of which are references to Section II. The first letter reference column 5 and the second letter references a maintenance function, column 3, A through K.

b. *Remarks.* This column lists information pertinent to the maintenance function being performed, as indicated on the MAC, Section II.

## Section II. MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Functions group	(3) Maintenance functions											(4) Remarks
		A	B	C	D	E	F	G	H	I	J	K	
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	
01	ENGINE												
0100	Engine Assembly .....	F	O	C		O		O	O	H			
13	WHEELS AND TRACKS												
1311	Wheel Assembly .....			O					O	O			
1313	Tires and Tubes:												
	Tire and tube .....	C		C					O	O			
16	SPRINGS												
1601	Springs .....			C					O				
40	ELECTRIC MOTORS												
4000	Motor Assembly .....	F	F					O	O	H			
60	HEATING UNITS, BURNERS												
6000	Heater, Duct Type .....			C	C				C	F	H		
6004	Fuel System:												
	Filter fluid .....			C					O				
	Pump fuel .....		C			C	O		O	F			
6005	Burner Assembly:												
	Magneto .....	O				O			O	O			
	Ignitor .....	O		O					O				
	Cable assembly .....	O							O				
	Nozzle-fuel .....	O		O					O				

(1) Group No.	(2) Functions group	(3) Maintenance functions											(4) Remarks
		A	B	C	D	E	F	G	H	I	J	K	
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	
6007	Fuel Tank .....			C					F	F			
6008	Blower Assembly .....							O	F	F			
6010	Exhaust System .....								O	O			
6011	Combustor Assembly .....								F	F			
6013	Heat Exchanger .....					O			F	F			

Page 113. Appendix III, Basic Issue Items List and Operating Supplies is superseded as follows:

## APPENDIX III BASIC ISSUE ITEMS LIST

### Section I. INTRODUCTION

#### 1. Scope

This appendix lists items which accompany the heater, duct type, or are required for installation, operation, or operator's maintenance.

#### 2. General

This Basic Issue Items List is divided into the following sections:

a. Basic Issue items — Section II. A list of items which accompany the heater, duct type, and are required by the operator/crew for installation, operation, or maintenance.

b. Maintenance and Operating Supplies — section III. A listing of maintenance and operating supplies required for initial operation.

#### 3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items, Section II.

a. Source, Maintenance, and Recoverability Codes (SMR):

(1) Source code, indicates the source for the listed item. Source codes are:

Code	Explanation
P	Repair parts which are stocked in or supplied from the GSA/DSA, or Army supply system and authorized for use at indicated maintenance categories.
P2	Repair parts which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.
M	Repair parts which are not procured or stocked, but are to be manufactured in indicated maintenance levels.
A	Assemblies which are not procured or stocked as such, but are made up of two or more units. Such component units carry individual stock numbers and descriptions are procured and stocked separately and can be assembled to form the required assembly at indicated maintenance categories.
X	Parts and assemblies which are not procured or stocked and the mortality of which normally is below that of the applicable end item or component. The failure of such part or assembly should result in retirement of the end item from the supply system.
X1	Repair parts which are not procured or stocked. The requirement of such items will be filled by the use of the next higher assembly or component.

Code	Explanation
X2	Repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain them through cannibalization. Where such repair parts are not obtainable through cannibalization, requirements will be requisitioned, with accompanying justification, through normal supply channels.
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above GS and DS level or returned to depot supply levels.

(2) Maintenance code, indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is:

Code	Explanation
C	Operator/crew

(3) Recoverability code, indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are:

Code	Explanation
R	Repair parts (assemblies and components) which are considered economically repairable at direct and general support maintenance levels. When the maintenance capability to repair these items does not exist, they are normally disposed of at the GS level. When supply considerations dictate, some of these repair parts may be listed for automatic return to supply for depot level repair as set forth in AR 710-50. When so listed, they will be replaced by supply on an exchange basis.
S	Repair parts and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically repairable they will be evacuated to a depot for evaluation and analysis before final disposition.
T	High dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts are normally repaired or overhauled at depot maintenance activities.
U	Repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, or high dollar value reusable casings or castings.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required. The abbreviation "w/e" when used as a part of the nomenclature, indicates the

Federal stock number, includes all armament, equipment, accessories, and repair parts issued with the item. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parenthesis. Repair parts quantities included in kits, sets, and assemblies are shown in front of the repair part name.

d. Unit of Measure (U/M). A 2 character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Incorporated in Unit. This column indicates the quantity of the item used in the assembly group. A "V" appearing in this column in lieu of a quantity indicates that a definite quantity cannot be indicated (e.g., shims, spacers, etc.).

f. Quantity Furnished With Equipment. This column indicates the quantity of an item furnished with the equipment.

g. Illustration. This column is divided as follows:

(1) Figure Number. Indicates the figure number of the illustration in which the item is shown.

(2) Item Number. Indicates the callout number used to reference the item in the illustration.

#### 4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies — Section III

a. Component Application. This column identifies the component application of each maintenance or operating supply item.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the item name and brief description.

d. Quantity Required for Initial Operation. This column indicates the quantity of each maintenance or operating supply item required for initial operation of the equipment.

e. Quantity Required for 8 Hours Operation. This column indicates the estimated quantities required for an average 8 hours of operation.

f. Notes. This column indicates informative notes keyed to data appearing in a preceding column.

## Section II. BASIC ISSUE ITEMS

(1) SMR code	(2) Federal stock number	(3) Description		(4) Unit of meas	(5) Qty inch in unit	(6) Qty furn with equip	(7) Illustration	
		Ref No. & Mfr code	Usable on code				(A) fig no.	(B) item no.
PC		Group 01-PUBLICATIONS						
		ARMY TECHNICAL MANUAL				1		
PC		TM 5-2805-256-14				1		
		TM 5-4520-208-15						
PC		ARMY LUBRICATION ORDER						
		LO 5-2805-256-12				1		

### Section III. MAINTENANCE AND OPERATING SUPPLIES

(1) Component application	(2) Federal stock number	(3) Description	(4) Quantity required l/initial operation	(5) Quantity required l/h hrs operation	(6) Notes
CRANKCASE	..... 9150-265-9435 (2)	OIL, LUBRICATING: 5 gal drum as follows: OE-30 .....	2 pt		(1) See LO 5-2805-256-12 for engine lubrication. (2) See C1900-IL for additional data and requisitioning procedure. (3) Tank capacity. (4) Average fuel consumption for maximum usage.
	9150-265-9428 (2)	OE-10 .....	2 pt		
	9150-242-7603 (2)	OES .....	2 pt		
	.....	FUEL, GASOLINE: Bulk as follows'	16 gal (3)	36.2 gal (4)	
TANK, FUEL	9130-160-1818	Automotive Combat 91A	16 gal		
	9130-160-1830	Automotive Combat 91C	16 gal		

By Order of the Secretary of the Army:

Official:

KENNETH G. WICKHAM,  
*Major General, United States Army,*  
*The Adjutant General.*

W. C. WESTMORELAND,  
*General, United States Army,*  
*Chief of Staff.*

**Distribution:**

To be distributed in accordance with DA Form 12-25, Section III (qty rqr block no. 602) Organizational Maintenance requirements for Heaters, Space, 400,000 BTU.

CHANGE

No. 5

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D.C. 26 May 1972

**Operator, Organizational, Direct Support, General Support, and Depot  
Maintenance Manual**

**HEATER, DUCT-TYPE, PORTABLE; 400,000 BTU/HR;  
GASOLINE ENGINE-AND ELECTRIC MOTOR-DRIVEN BLOWER;  
W/6 AND 12-INCH DUCTS; AUTOMATIC TEMPERATURE  
CONTROL; TRAILER MOUNTED (AMERICAN AIR  
FILTER CO., INC. MODEL BT400-40) FSN 4520-792-8257;  
(MODEL BT400-40-1) FSN 4520-915-7789**

TM 5-4520-208-15, 20 March 1967, is changed as follows:

The title is changed to read as shown above.

Page 24. Paragraph 35c is added as follows:

*c. Duct Installation.* After starting the heater, hold the 12-inch duct (2, fig. 9) in front of the heater discharge end until the duct "release" is free. Attach the duct to the adapter assembly (1). The heat will permit the duct to be expanded normally without damaging the duct. Attach the duct adapter and the 6-inch ducts to the adapter. The hoses can be expanded normally after heating. If the heater is to be stored after shut-down, compress the ducts before disconnecting from the adapters.

Page 37. Paragraph 49.1 is added as follows:

**49.1 Air Duct Repair**

*a. General.* Pressure sensitive tape (FSN 8135-890-9875) is used for repairs to the air ducts.

*b. Cleaning.* Clean the area of the duct to be

repaired with a cloth dampened with cleaning solvent. Allow duct to dry thoroughly.

*c. Repair.* Trim rough edges of damaged area. Apply tape to duct and press firmly to assure good adherence. In large damaged areas, apply tape to both inside and outside of duct for better adherence.

Page 45. Make the following changes to legend of figure 25;

1. Bushing, sleeve.
2. Bushing, sleeve coupling.

Page 52. Paragraph 83d is superseded as follows:

*d. Installation.* Install the igniter plug (5, fig 31) in plate (4). Refer to figure 32 and measure the gap between the igniter plug electrode (3) and the electrode (1). The gap should be 1/8 inch or 0.125-to 0.1875-inch. Bend electrode (1) to obtain correct gap.

Page 113. Appendix III is superseded as follows:

**APPENDIX III**

**BASIC ISSUE ITEMS LIST AND ITEMS  
TROOP INSTALLED OR AUTHORIZED**

**Section 1. INTRODUCTION**

**B-1. Scope**

This appendix lists items required by the operator for operation of the heater.

**B-2. General**

This list is divided into the following sections:

*a. Basic Issue Items List -Section II.* Not applicable.

*b. Items Troop Installed or Authorized List -Section III.* A list of items in alphabetical sequence, which at the discretion of the unit commander may accompany the heater. These



items are NOT SUBJECT TO TURN-IN with the heater when evacuated.

### B-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items List, Section II, and Items Troop Installed or Authorized, Section III.

a. *Source, Maintenance, and Recoverability Code(s) (SMR):*

(1) *Source Code*, indicates the source for the listed item. Source codes are:

Code	Explanation
P	Repair parts, special tools, and test equipment supplied from GSA/DSA or Army supply system and authorized for use at indicated maintenance levels.
P2	Repair parts, special tools, and test equipment which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.

(2) *Maintenance code*, indicates the lowest level of maintenance authorized to install the listed item. The maintenance level code is:

Code	Explanation
C	Crew/Operator

(3) *Recoverability code*, indicates whether unserviceable items should be returned for re-

covery or salvage. Items not coded are nonrecoverable. Recoverability codes are:

Code	Explanation
R	Applied to repair parts (assemblies and components), special tools, and test equipment which are considered economically repairable at direct and general support maintenance levels.
S	Repair parts, special tools, test equipment and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis.

b. *Federal Stock Number*. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. *Description*. This column indicates the Federal item name and any additional description of the item required.

d. *Unit of Measure (U/M)*. A 2 character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. *Quantity Furnished with Equipment (BIIL)*. (Not applicable).

f. *Quantity Authorized (Items Troop Installed or Authorized)*. This column indicates the quantity of the item authorized to be used with the equipment.

### Section III. ITEMS TROOP INSTALLED OR AUTHORIZED LIST

(1) SMR Code	(2) Federal Stock Number	(3) Description  Ref No. & Mfr Code  Usable on Code	(4) Unit of Meas	(5) Qty Auth
PC	7520-559-9618	CASE, maintenance and operation manuals	EA	1

By Order of the Secretary of the Army:

Official:

VERNE L. BOWERS,  
Major General, United States Army,  
The Adjutant General.

W. C. WESTMORELAND,  
General, United States Army,  
Chief of Staff.

Distribution:

To be distributed in accordance with DA Form 12-25C (qty rqr block No. 602) organizational maintenance requirements for Heaters, Space, 400,000 BTU.

GPO 900-352

Changes in force: C 4, C 5, and C 6

**TM 5-4520-208-15**

C 6

Change }  
No. 6 }

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
Washington, D.C. 22 February 1973

Operator, Organizational, Direct and General Support, and  
Depot Maintenance Manual  
HEATER, DUCT-TYPE; PORTABLE; 400,000 BTU/HR; GASOLINE ENGINE-  
AND ELECTRIC MOTOR-DRIVEN BLOWERS; W/6- AND 12-INCH DUCTS;  
AUTOMATIC TEMPERATURE CONTROL; TRAILER MOUNTED (AMERICAN AIR  
FILTER CO. INC. MODEL BT 400-40) FSN 4520-792-8257 (MODEL  
BT400-40-1 FSN 4520-915-7789 (MODEL BT400-40-1A) FSN 45-223-3221

TM5-4520-208-15, 20 March 1957, is changed as follows:

The title is changed to read as shown above.

*Page 7.* Paragraph 5, line 15, add a new sentence. "The model BT400-40-1A is identical to Model BT400-40-1, except it is furnished with electric motor power unit as used on Model BT400-40."

*Page 107.* Paragraph A-2 is superseded as follows:

**A-2. Painting.**

AR 740-1	Color, Marking, and Preparation of Equipment for Shipment
AR 746-5	Color and Marking of Army Materiel

*Paragraph A-3.* Reference TM 38-750 is changed to read "The Army Maintenance Management System".

By order of the Secretary of the Army:

**CREIGHTON W. ABRAMS**  
*General, United States Army*  
*Chief of Staff*

Official:

**VERNE L. BOWERS,**  
*Major General, U.S. Army,*  
*The Adjutant General.*

Distribution:

To be distributed in accordance with DA Form 12-25C (qty rqr block No. 602), Organizational maintenance requirements for Heaters, Space, 400,000 BTU.

Changes in Force: C4, C5, C6 and C7

TM 5-4520-208-15  
C7

CHANGE

NO. 7

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D C, 21 November 1977

Operator, Organizational, Direct and General  
Support and Depot Maintenance Manual

HEATER, DUCT-TYPE, PORTABLE; 400,000 BTU/HR; GASOLINE ENGINE  
AND ELECTRIC MOTOR-DRIVEN BLOWERS; W/6 AND 12-INCH DUCTS;  
AUTOMATIC TEMPERATURE CONTROL; TRAILER MOUNTED  
(AMERICAN AIR FILTER CO., INC. MODEL BT400-40)  
NSN 4520-00-792-8257 (MODEL BT400-40-1)  
NSN 4520-00-915-7789 (MODEL BT400-40-1A)  
NSN 4520-00-223-3221

TM 5-4520-208-15, 20 March 1967, is changed as follows:

Cover Page and Table of Contents pages are  
changed to read as shown above.

*Page 1, paragraph 1e* is superseded as follows:

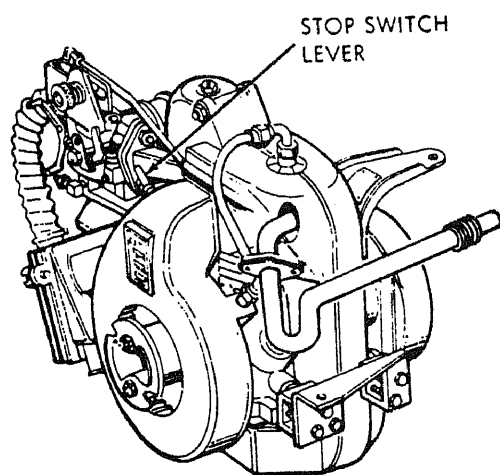
You can help improve this manual. If you find any mistake or if you know of any way to improve the procedure, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publication and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, US Army Troop Support and Aviation Materiel Readiness Command, ATTN: DRSTS-MTPS, 4300 Goodfellow Blvd., St. Louis, MO 63120. A reply will be furnished to you.

*Page 4, paragraph 3b, line 6:* Add the following sentence after "electric motor". Heater model BT400-40-1, serial nos. 4400866 and subsequent are only equipped with the Military Standard Engine, Model 1A08-III Power Unit. The engine exhaust system is also different.

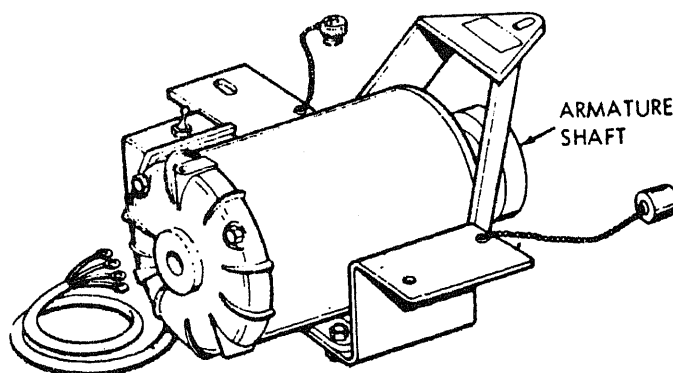
*Page 8, paragraph 6(c)3.* Add the following:  
Rotation                      counter- clockwise.

*Page 12.* Change the caption on figure 6 to read "Power units, mounting brackets, Models BT400-40 and BT400-40-1".

Figure 6.1 is added as follows:



MILITARY STANDARD  
ENGINE MODEL 1A08-IL  
GASOLINE ENGINE  
POWER UNIT



ELECTRIC MOTOR  
POWER UNIT

MEC 4520-208-15/6.1

*Figure 6.1 Power units mounting brackets Model BT400-40-1, Serial No's BT4400866 and subsequent.*

**Page 14.** Change the caption on figure 7 to read  
"Gasoline engine power unit, installed view. Models

BT400-40 and BT400-40-1."

Figure 7.1 is added as follows:

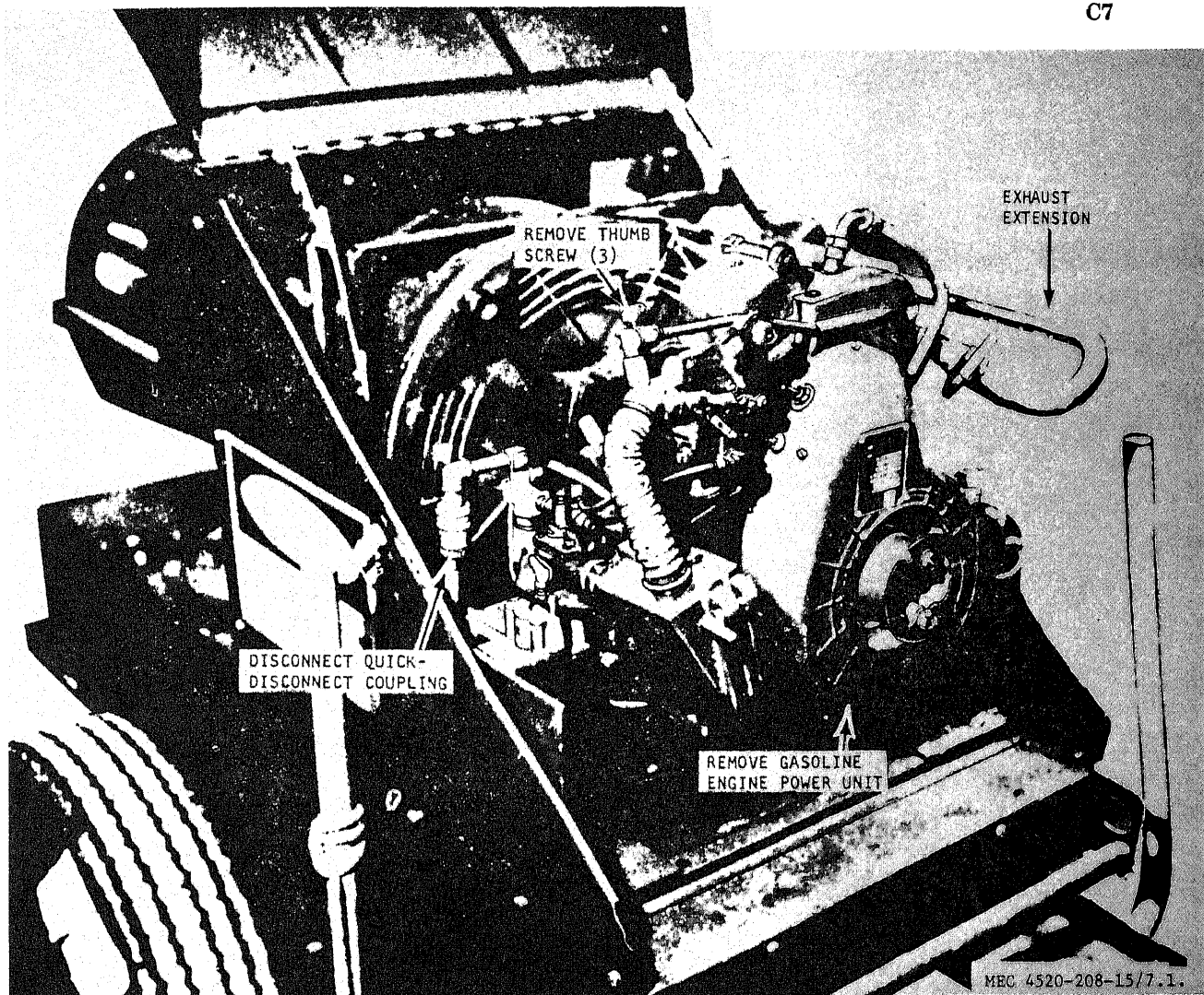


Figure 7.1 Gasoline engine power unit, installed view. Model BT400-40-1, Serial No's BT4400866 and subsequent.

Page 15, paragraph 12c(1)(c) is superseded as follows:

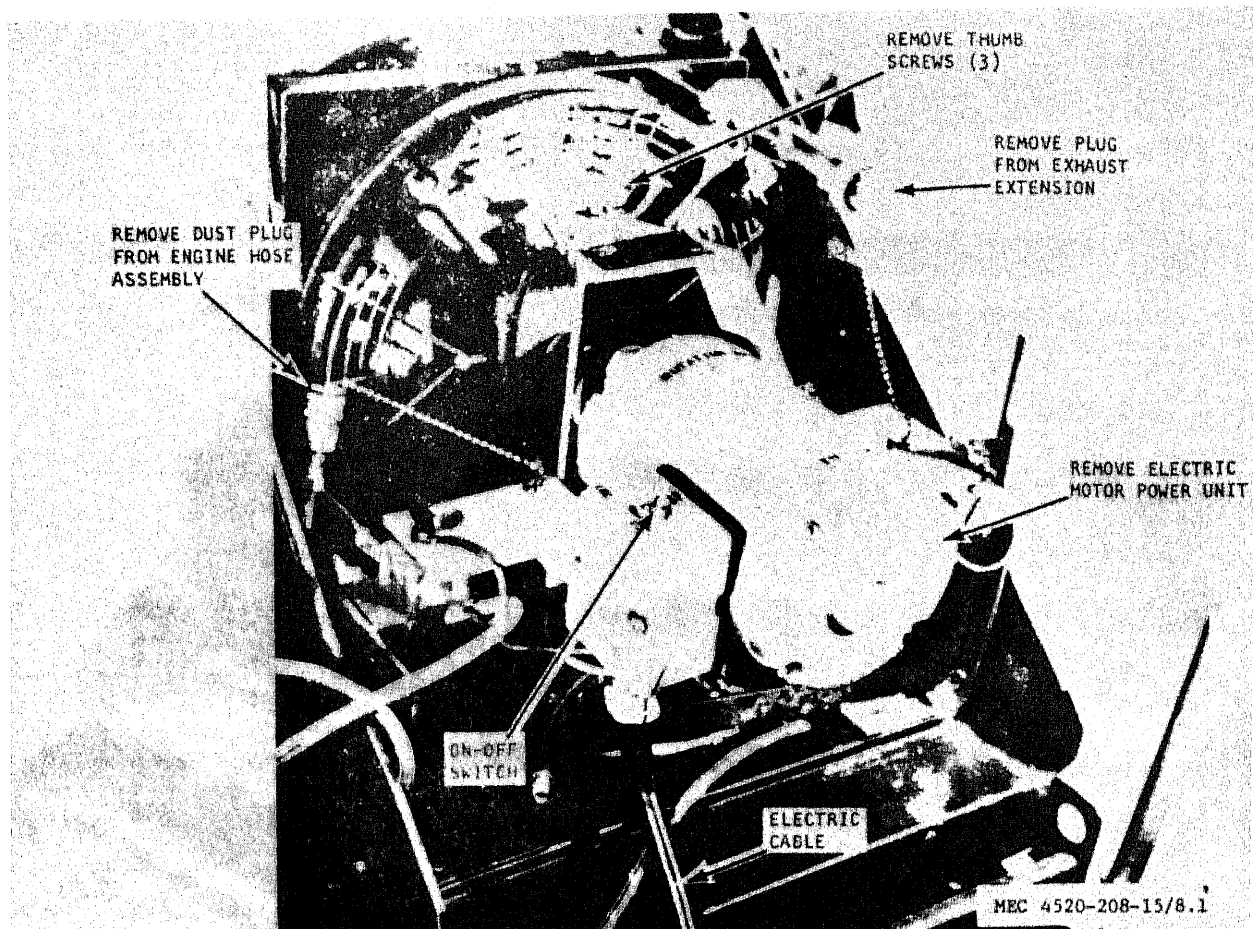
(c) On Model BT400-40-1 and BT400-40-1A heaters, disengage cabinet latches and open cabinet (fig. 1).

Paragraph 12c(1)(d) is superseded as follows:

(d) Remove engine exhaust plug (fig. 8) from exhaust extension and dust plug from engine hose assembly quick-disconnect coupling.

Change the caption on figure 8 to read "Electric motor power unit, installed view Models BT400-40 and BT400-40-1."

Figure 8.1 is added as follows:



**Figure 8.1** Electric motor power unit, installed view Model BT400-40-1, Serial No's BT4400866 and subsequent.

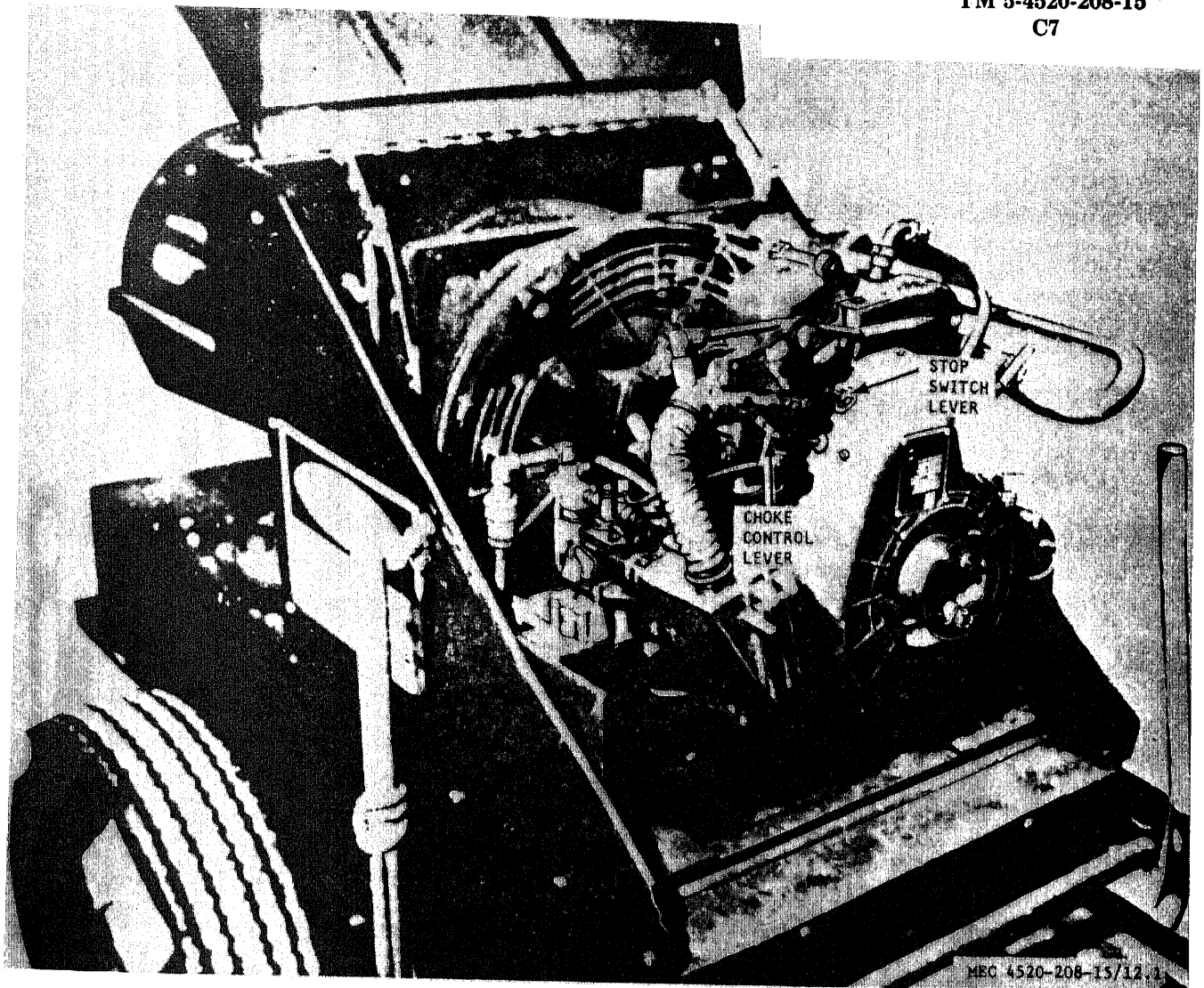
**Page 20, paragraph 25b.1** is added as follows:

**b.1.** (BT400-40-1, Serial Numbers BT4400866 and subsequent). An exhaust extension leading from the manifold has a sleeve inserted at the end. The exhaust pipe is inserted into the exhaust extension sleeve. A flexible bellows and O-ring on the ex-

haust pipe provide spring pressure O-ring seal for a gastight fitting between the exhaust pipe and the exhaust extension.

Change the caption on figure 12 to read "Gasoline engine power unit controls Models BT400-40 and BT400-40-1."

Figure 12.1 is added as follows:



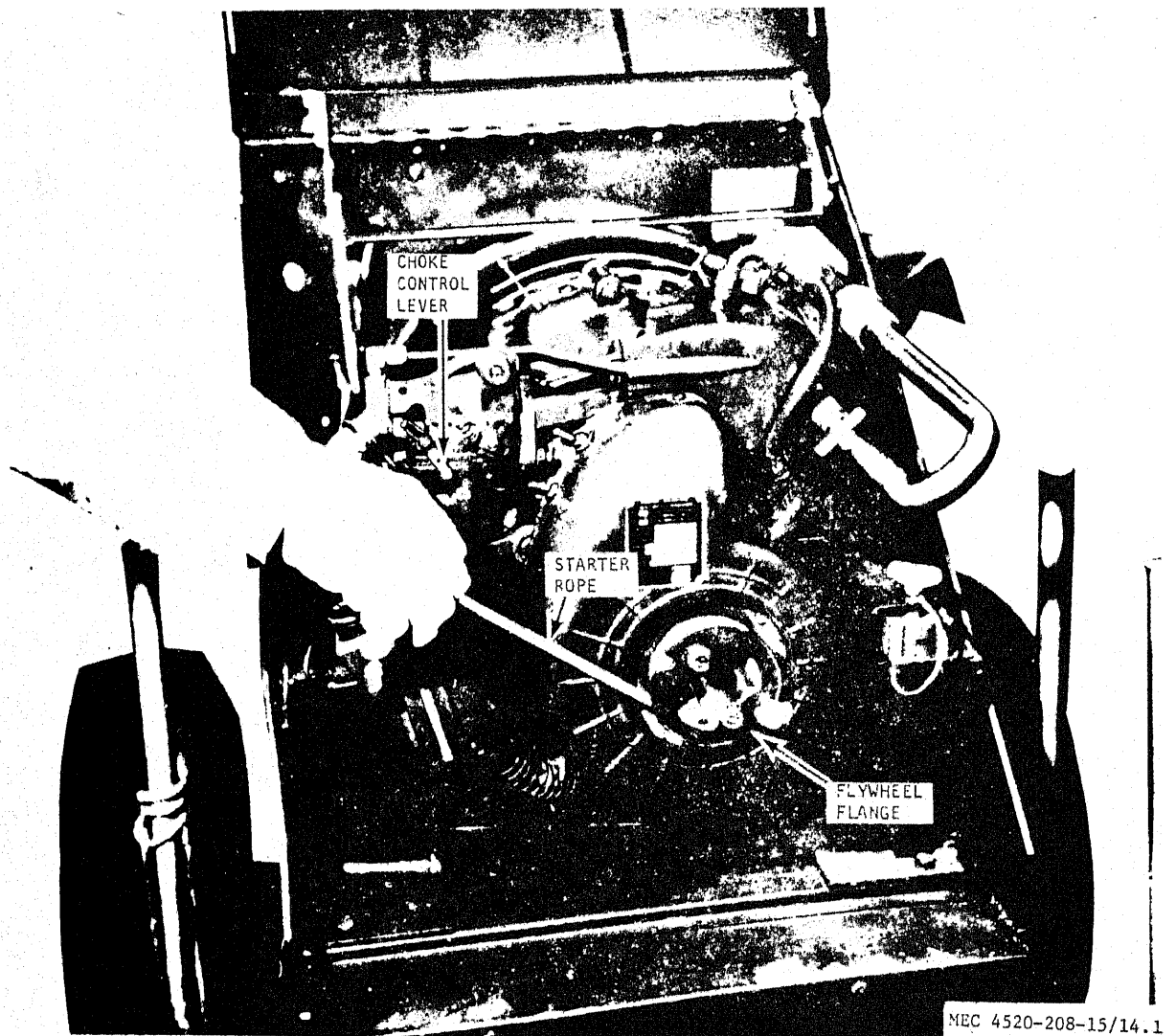
*Figure 12.1. Gasoline engine power unit controls Model BT400-40-1, Serial No's BT4400866 and subsequent.*

**Page 22.** Change the caption on figure 14 to read  
"Starting gasoline engine power unit, Models

BT400-40 and BT400-40-1."

Figure 14.1 is added as follows:





*Figure 14.1. Starting gasoline engine power unit, Model BT400-40-1, Serial No's BT4400866 and subsequent.*

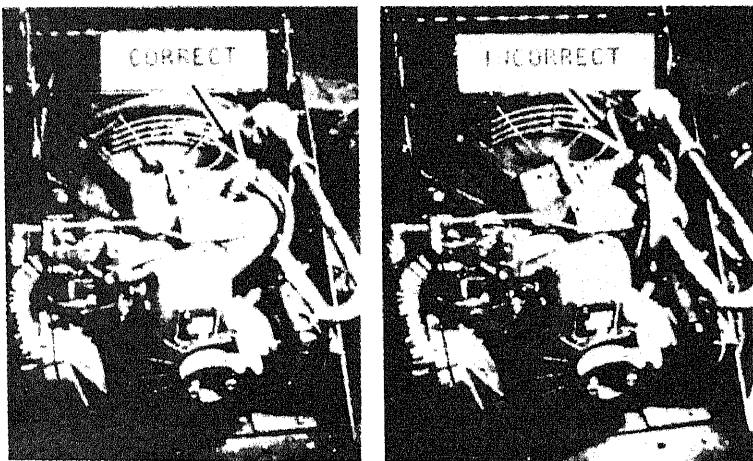
**Page 23, paragraph 32d (2)** is superseded as follows:

(2) Set temperature selector valve to low position.

**Paragraph 34b(3)** is superseded as follows:

(3) After warm air temperature has stabilized at heater outlet, rotate temperature selector valve knob (fig. 11) to desired discharge temperature.

**Page 32. Sheet 2 of figure 18** is superseded as follows:

ITEM		PAR	REF
6	<u>TIME TOTALIZING METER DRIVE BELT (BT400-40).</u> Check belt for wear and for tension. Replace belt if worn or stretched.		102
7	<u>EXHAUST PIPE.</u> Check exhaust pipe for secure mounting and dents or other damage. Check end where exhaust extension from engine is inserted for dents or crimps which may cause leaks.		79
8	<u>SPARK PLUG CABLE.</u> Check cable for CORRECT position as illustrated to keep cable nut from making contact with heater cover.  		32
<p><u>NOTE 1. OPERATION.</u> During operation observe any unusual noises or vibrations.</p>			
<p><u>NOTE 2. AFTER OPERATION.</u> Clean exterior of all dirt and oil.</p>			

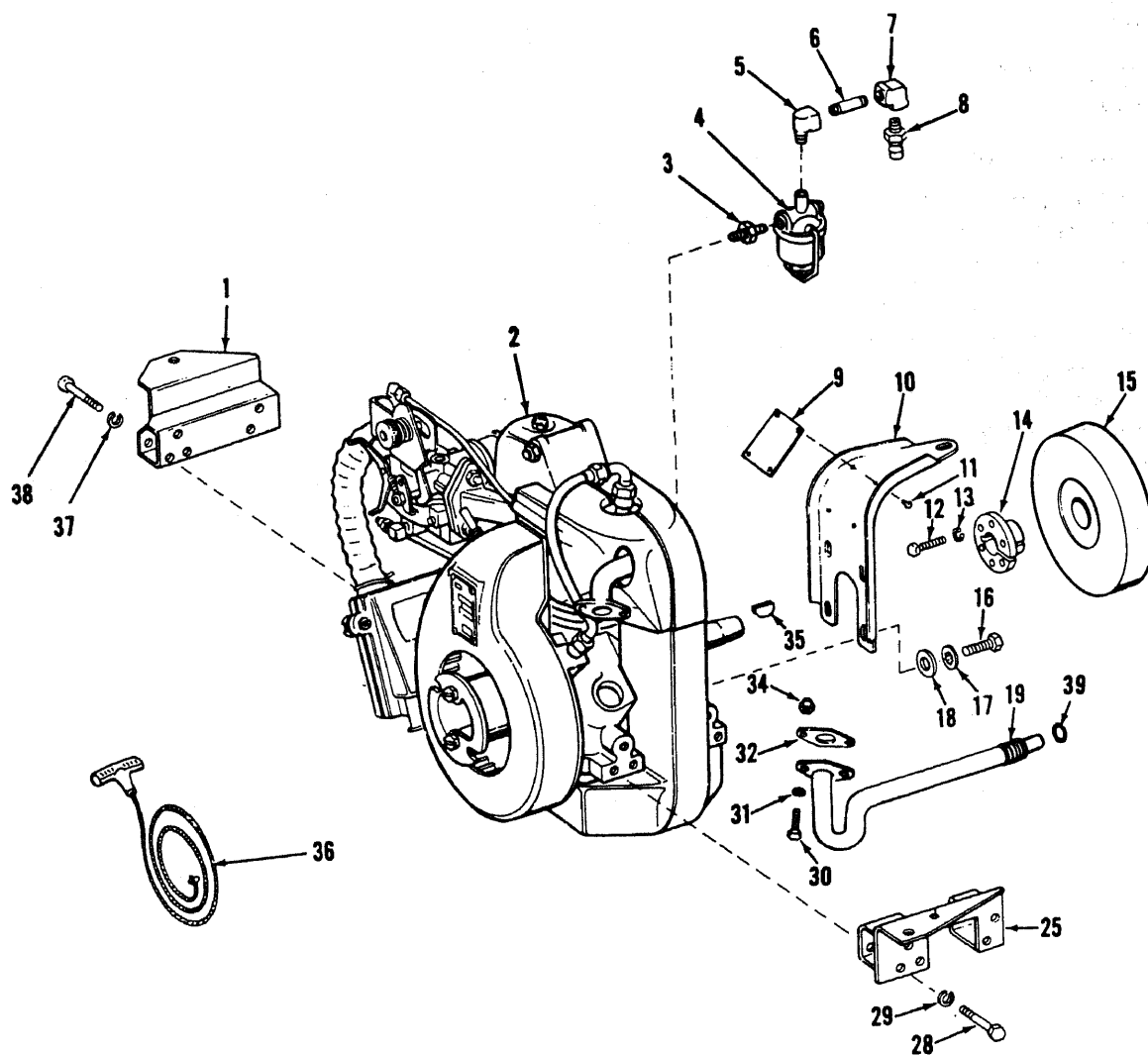
MEC 4520-208-15/18 (2)

Figure 18 (2)—Continued.

Page 42. Change the caption on figure 24 to read  
"Gasoline engine power unit, exploded view, Models

BT400-40 and BT400-40-1."

Figure 24.1 and key are added as follows:



MEC 4520-208-15/24.1

1. Left side engine mounting bracket
2. Gasoline engine, Model 1A08-III
3. Pipe nipple
4. Gasoline engine fuel filter
5. Pipe elbow
6. Pipe nipple
7. Elbow, pipe to tube
8. Quick disconnect coupling half

9. Identification plate, power unit
10. Front engine mounting bracket
11. Blind rivet (4)
12. Screw, cap, hex hd, No. 10-24 x 1 in. (3)
13. Washer, lock, No. 10 (3)
14. Tapered bushing
15. Drive coupling
16. Bolt, machine, 5/16-24 x 5/8 in. (4)

- 17. Washer, lock, IT, 5/16 in. (4)
- 18. Washer, flat, 5/16 in. (4)
- 19. Exhaust pipe
- 20. Deleted
- 21. Deleted
- 22. Deleted
- 23. Deleted
- 24. Deleted
- 25. Right side engine mounting bracket
- 26. Deleted
- 27. Deleted

- 28. Screw, cap, hex hd, 1/4-20 x 2-1/2 in. (5)
- 29. Washer, lock, 1/4 in. (5)
- 30. Screw, machine, No. 10-24 x 7/8 in. (2)
- 31. Washer, flat, No. 10 (2)
- 32. Gasket
- 33. Deleted
- 34. Nut, plain, hex, No. 10-24 (2)
- 35. Key, woodruff
- 36. Rope starter assembly
- 37. Washer, lock, 1/4 in. (5)
- 38. Screw, cap, hex hd, 1/4-20 x 2-1/2 in. (6)
- 39. O-ring

**Figure 24.1. Gasoline engine power unit, exploded view, Model BT400-40-1, Serial No's BT4400866 and subsequent.**

**Page 43, paragraph 73b(4).** Add the following  
**NOTE:** Step 4 is not applicable to Model BT400-40-1, Serial numbers BT4400866 and subsequent. Proceed to step 5.

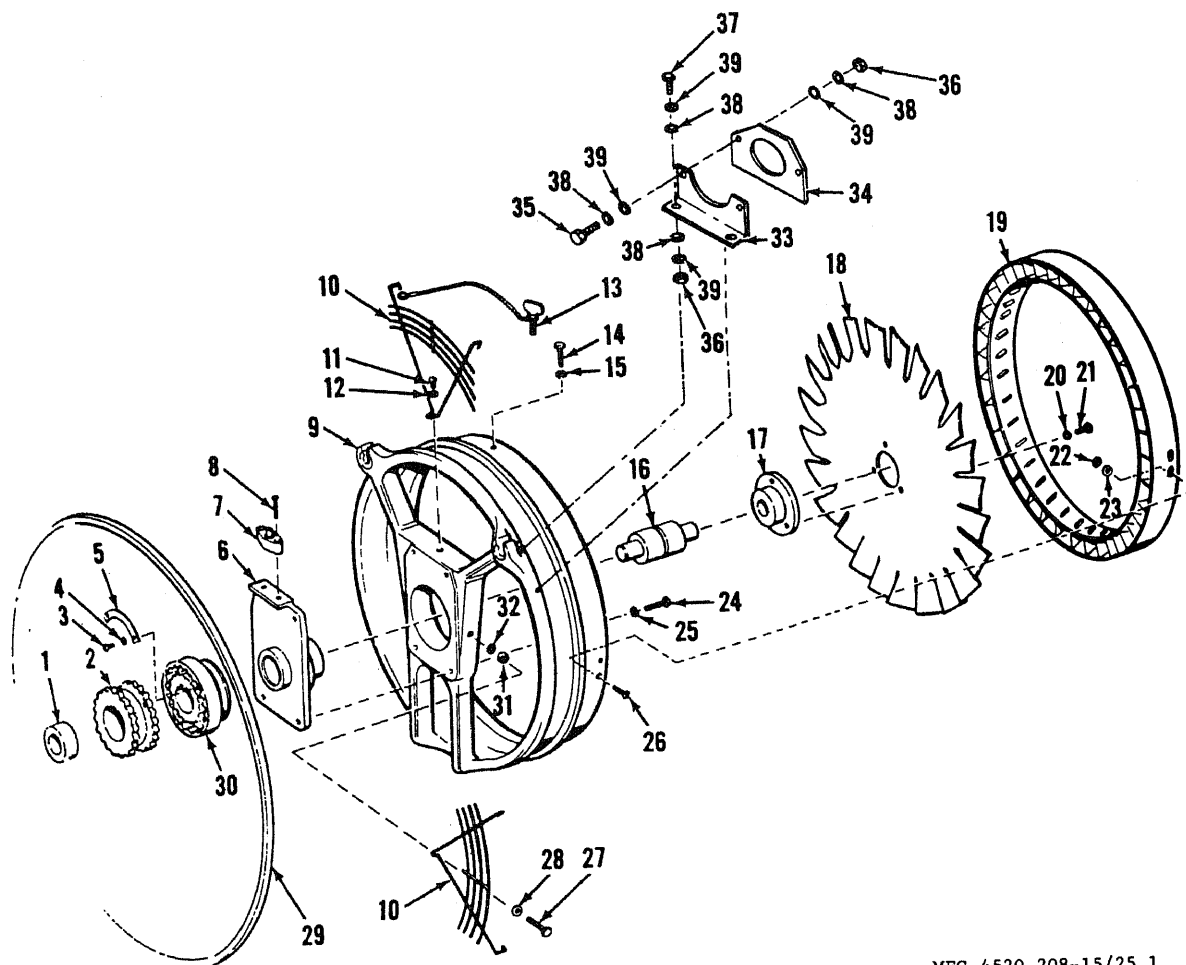
**Paragraph 73d(4).** Add the following  
**NOTE:** Step 4 is not applicable to Model BT400-40-1, Serial numbers BT4400866 and subsequent. Proceed to step 5.

**Page 44, paragraph 77b(4.1)** is added as follows:

(4.1) Remove the two 10-24 nuts (36, fig. 25), four lock washers (39), four flat washers (38) and two 1/2-inch machine screws (35) holding the exhaust pipe support to the angle bracket. Remove the mounting ring with attached fan and pulley from the heater.

**Page 45.** Change the caption on figure 25 to read "Fan and mounting ring, exploded view, Models BT400-40 and BT400-40-1."

Figure 25.1 and key are added as follows:



MEC 4520-208-15/25.1

- 1. Bushing, sleeve
- 2. Bushing, sleeve coupling
- 3. Screw, machine, No. 6-32 x 5/16 in. (4)
- 4. Washer, lock, No. 6 (4)
- 5. Retainer (2)
- 6. Fan bearing support
- 7. Resilient mount
- 8. Screw, machine, No. 8-32 x 1 1/8 in. (2)
- 9. Fan ring
- 10. Fan guard (3)
- 11. Screw, machine, 1/4-20 x 1/2 in.
- 12. Washer, lock, 1/4 in.
- 13. Thumb screw (3)
- 14. Screw, cap, hex hd, 1/4-20 x 1/2 in. (3) (BT400-40)
- 15. Washer, lock IT, 1/4 in. (3) (BT400-40)
- 16. Fan shaft bearing
- 17. Fan hub
- 18. Vaneaxial fan
- 19. Air straightening vane
- 20. Washer, lock, IT, 1/4 in. (3)
- 21. Screw, cap, hex hd, 1/4-20 x 1/2 in. (3)
- 22. Nut, self-locking, hex No. 8-32 (2)
- 23. Washer, lock, No. 8 (2)
- 24. Screw, cap, hex hd, 5/16-18 x 1 in. (4)
- 25. Washer, lock, 5/16 in. (4)
- 26. Screw, machine, No. 8-32 x 1/2 in. (2)
- 27. Screw, machine, 1/4-20 x 1-1/2 in. (2)
- 28. Washer, flat 1/4 in. (2)
- 29. V-belt, drive
- 30. Coupling half
- 31. Nut, plain, hex, 1/4-20 (2)
- 32. Washer, lock IT, 1/4 in. (2)
- 33. Angle bracket
- 34. Exhaust pipe support
- 35. Screw, cap, hex, 10-24 x 1/2 in. (2)
- 36. Nut, hex, 10-24 (4)
- 37. Screw, cap, hex, 10-24 x 1 in. (2)
- 38. Washer, flat, 10-24 (8)
- 39. Washer, flat, 10-24 (8)

Figure 25.1. Fan and mounting ring, exploded view. Model BT400-40-1, Serial No's BT4400866 and subsequent.

Page 46. Figure 26.1 is added as follows:

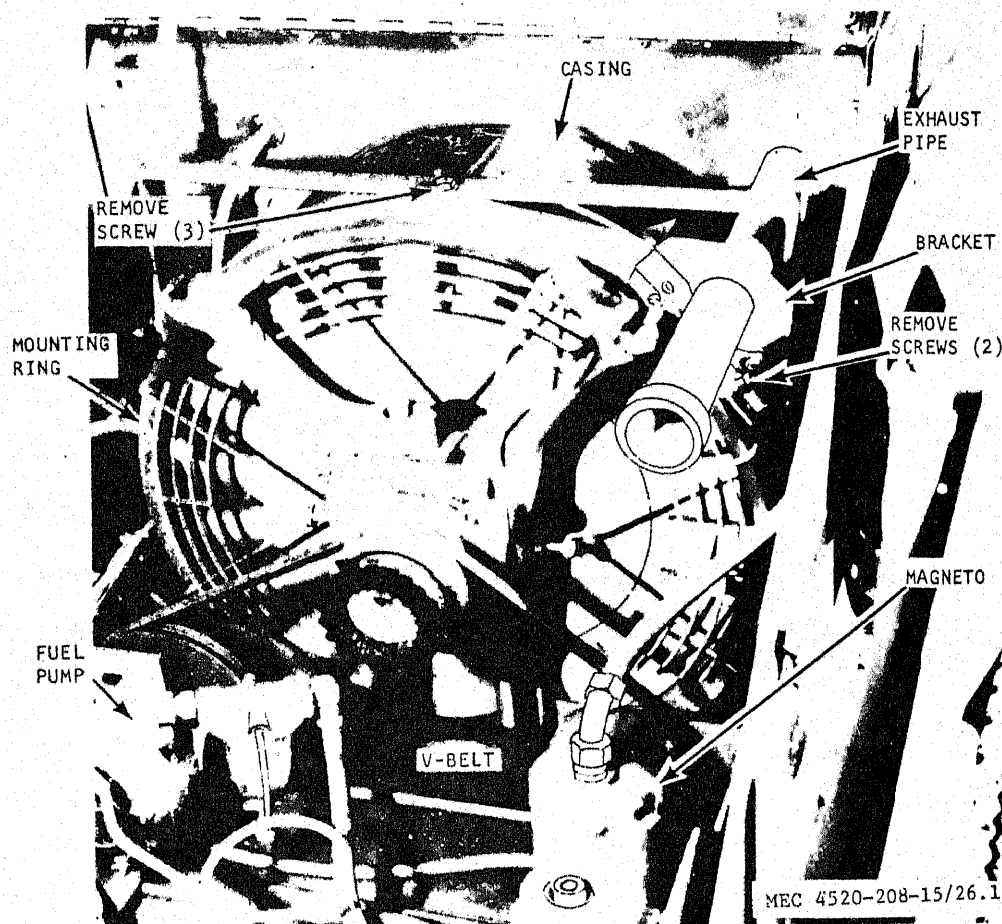


Figure 26.1. Fan mounting ring removal points, Model BT400-40-1, Serial No's BT4400866 and subsequent.

Page 47. Figure 27.1 is added as follows:

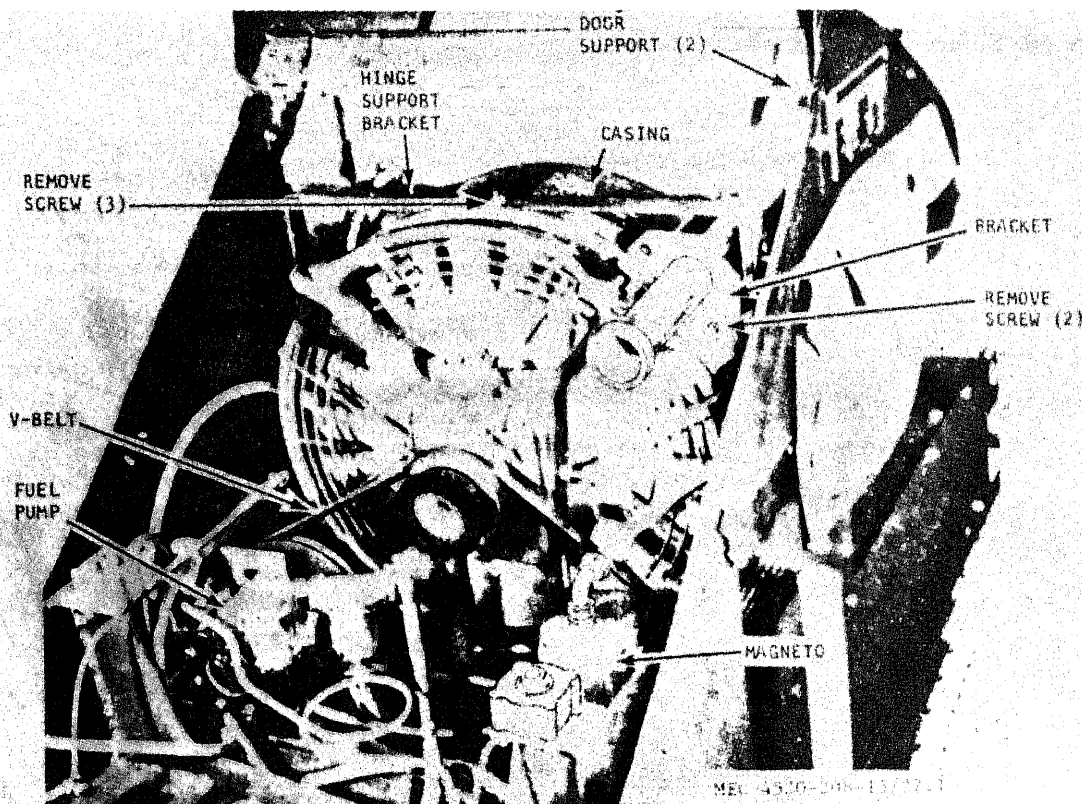


Figure 27.1. Fan mounting ring, removal points, Model BT400-40-1. Serial No's BT4400866 and subsequent.

Page 47, paragraph 77e (8.1) is added as follows:

(8.1) (BT400-40-1, Serial No's BT4400866 and subsequent. Attach exhaust pipe support (34, fig. 25.1) to angle bracket (33), using two screws (35) washers (38), washers (39) and nuts (36).

Paragraph 77f. Step (7) is added after step (6) as follows:

(7) heater Model BT400-40-1. Serial No's 4400866 and subsequent.

Page 48, paragraph 78.1 is added as follows:

78.1 General (BT400-40-1, applicable to all models.)

a. Exhaust gases from both the heater combustion chamber and the gasoline engine are carried by the exhaust stack away from the heater and into the atmosphere.

b. Exhaust gases from the heater flame pass from the combustion chamber through the heat ex-

changer and into the atmosphere through the exhaust stack.

c. Gases from the gasoline engine exhaust manifold muffler are carried by an exhaust pipe through an exhaust extension and into the atmosphere through the exhaust stack.

Page 48, paragraph 79.a.1 is added as follows:

a.1. General. (BT400-40, Serial No's BT4400866 and subsequent.)

(1) When the gasoline engine is mounted on the heater, the engine exhaust pipe joins to exhaust extension pipe (25, fig. 49.1) forming a gastight fitting.

(2) The extension pipe passes through a flange in the bulkhead and is attached to the exhaust stack. A metal shield (fig. 28.1) surrounds the exhaust extension to protect personnel from accidental burns.

*Page 48, paragraph 79.b.1* is added as follows:  
**b.1. Removal.** (BT400-40-1, Serial No's BT4400866 and subsequent.)

**WARNING**

To avoid burns, allow heater and power unit to cool off before attempting to remove any part of exhaust system.

(1) Remove the power unit from the heater using the procedure given in paragraph 12.

**CAUTION**

When handling the gasoline engine, do not lift by the attached exhaust pipe.

(2) Remove two screws (30, fig. 24.1), flatwashers (31), and nuts (34), allowing exhaust pipe (19) and gasket (32) to be removed from engine.

(3) Refer to figure 28.1 and remove brass sleeve from exhaust extension by tapping around inner shoulder of sleeve with rawhide mallet or other soft hammer.

**NOTE**

If, due to damage, sleeve and extension pipe are to be replaced, the sleeve end of the extension pipe can be removed with a hacksaw.

(4) Remove three screw, nuts, flatwashers and lockwashers securing publications case to heater. Remove case.

(5) Remove engine cabinet assembly using the procedure given in paragraph 70 d.

(6) Remove two screws, lockwashers and nuts securing exhaust shield to bulkhead, also one screw and two flatwashers securing exhaust shield to exhaust stack. Remove exhaust shield.

(7) Remove two screws, lockwashers and nuts securing exhaust pipe extension to exhaust stack.

(8) Remove two screws, lockwashers, flatwashers and nuts securing extension pipe support bracket to fan ring. Slide support bracket assembly off end of extension pipe.

(9) Remove the two screws, lockwashers, flatwashers and nuts securing the extension pipe passage flange to the heater bulkhead. Slide flange off end of extension pipe.

(10) Remove the exhaust pipe extension and stack gasket.

*Page 48, paragraph 79d.1* is added as follows:  
**d.1. Installation.** (BT400-40-1, Serial No's BT4400866 and subsequent.)

(1) Position the exhaust extension pipe on the exhaust stack (fig. 28.1) with pipe extending through the hole in the bulkhead. Loosely install two cap screws, flatwashers and nuts to hold pipe in place on stack. Do not tighten hardware until all supporting pieces are in place and aligned.

(2) Slide flange onto extension pipe. Do not affix to bulkhead until step (4).

(3) Slide support bracket assembly onto extension pipe. Do not attach to fan ring until step (4).

(4) Secure flange to bulkhead with two screws, lockwashers and two nuts. Secure pipe-to-stack hardware installed in step (1). Secure support bracket assembly to fan ring with two screws, flatwashers and four nuts.

(5) Using a rawhide mallet or other soft hammer, carefully drive brass sleeve onto end of extension pipe.

(6) Position exhaust shield over extension pipe between bulkhead and exhaust stack. Secure exhaust shield to exhaust stack with one screw and two flatwashers. Secure exhaust shield to bulkhead with two screws, two washers and two nuts.

(7) Install publications case on heater and secure with three screws, flatwashers, lockwashers and nuts.

(8) Refer to figure 24.1 and install gasket (32) and exhaust pipe (19) on gasoline engine power unit. Secure exhaust pipe to engine with two screws (30), flatwashers (31), and nuts (34).

(9) Refer to paragraph 12 and install power unit on heater.

*Page 48.* Change the caption on figure 28 to read: "Exhaust system, removal points, Models BT400-40 and BT400-40-1."

Figure 28.1 is added as follows:



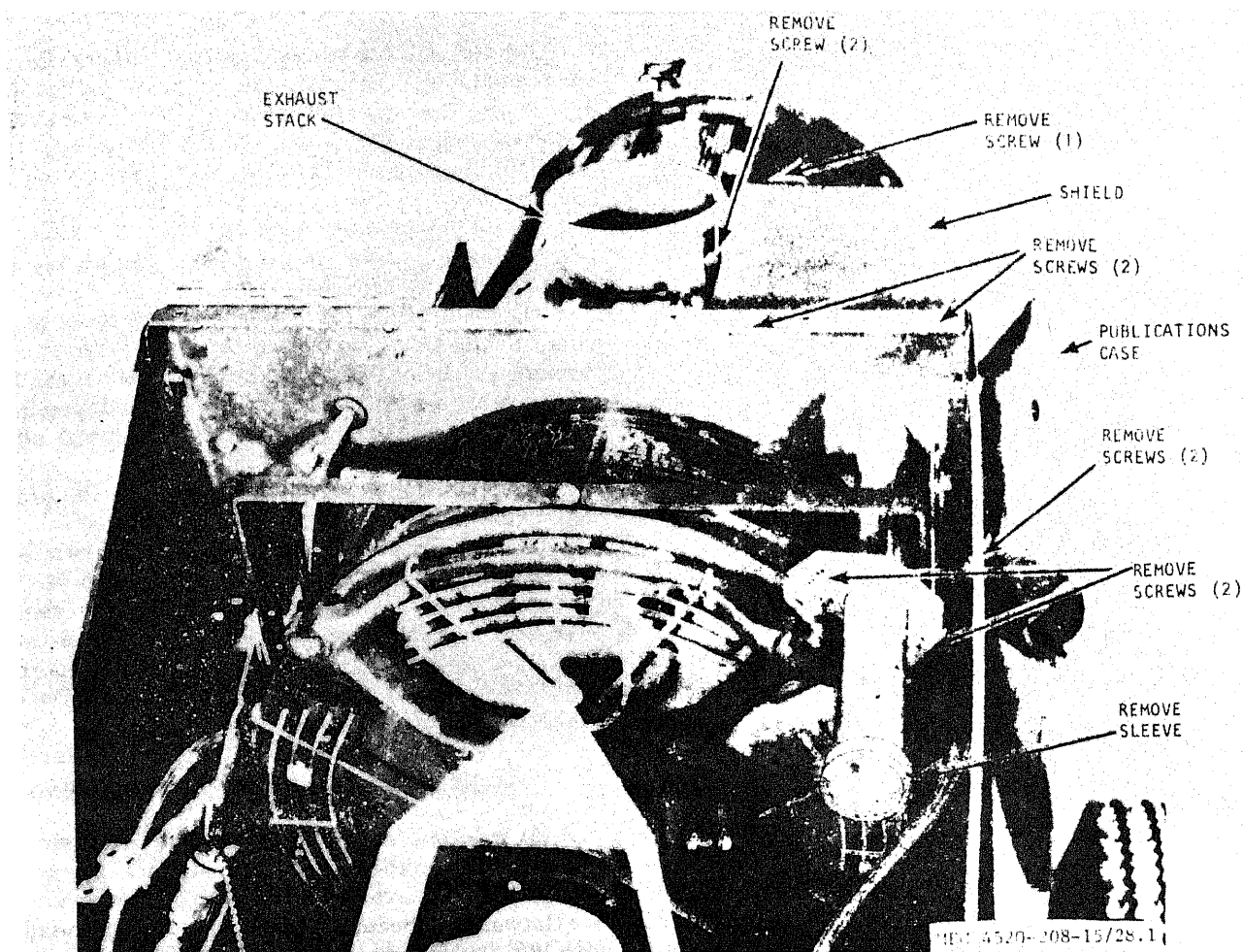


Figure 28.1. Exhaust System, removal points Model BT400-40-1, Serial No's BT4400866 and subsequent.

Page 62, paragraph 93a.1 is added as follows:

**a.1 General.** (BT400-40-1, Serial No's BT4400866 and subsequent). Fuel from the tank passes through an automotive type filter before entering the fuel pump. The filter on Model BT400-40-1 heater, Serial numbers BT4400866 and subsequent, contains a 62-micron metal-edge element which must be removed and cleaned at periodic intervals.

Paragraph 93b.1 is added as follows:

**b.1 Servicing.** (BT400-40-1, Serial No's BT4400866 and subsequent.)

- (1) Refer to paragraph 12 and remove the power unit.
- (2) Loosen knurled nut (3, fig. 38.1) and rotate retaining bail (2).
- (3) Remove metal bowl (6) from top casting (1).
- (4) Remove gasket (4). Check for damage or deterioration. Replace if required.

# CAUTION

The filter element consists of metal disks stacked on a threaded stem. When removing the element, take care to ensure that the disks do not fall off the stem.

(5) Unscrew filter element (5) from top casting (1). Screw an 8-36 nut on the filter element stem, hand tight, to hold disks on stem during cleaning.

(6) Clean filter element in a suitable solvent and dry with compressed air. Replace the entire filter element if defective.

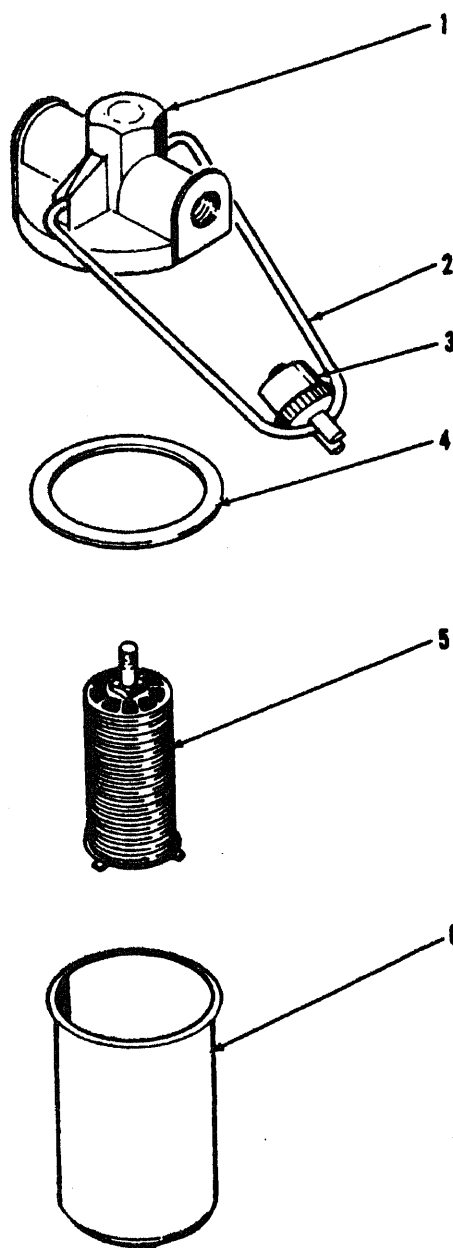
(7) Install gasket (4) in top casting (1).

(8) Remove retaining nut and screw element (5) into top casting (1). Use no tools, but tighten the filter element as securely as possible by hand.

(9) Install bowl to top casting and secure with retaining bail and knurled nut.

(10) Install power unit (para. F2).

Page 63. Figure 38.1 and key are added as follows:



MEC 4520-208-15/38.1

1. Topcasting
2. Retaining Bail
3. Star Nut

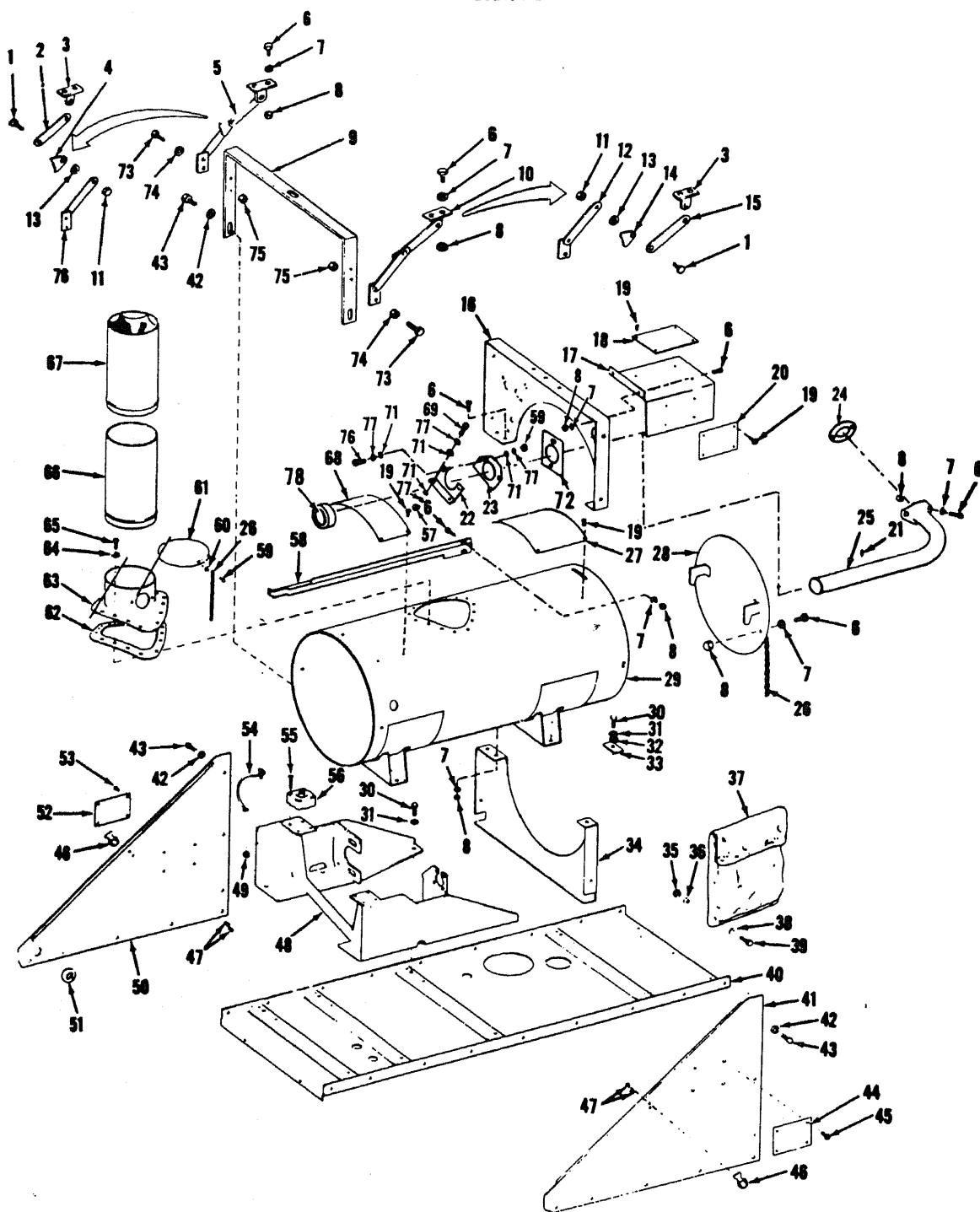
4. Headgasket
5. Filter Element
6. Metal Bowl

Figure 38.1 Heater fuel filter, exploded view, Model BT400-40-1, Serial No's BT4400866 and subsequent.

Page 94. Change the caption of figure 49 to read: "Casing, bulkheads and power unit support,

exploded view, Models BT400-40 and BT400-40-1.

Figure 49.1 and key are added as follows:



MEC 4520-208-15/49.1

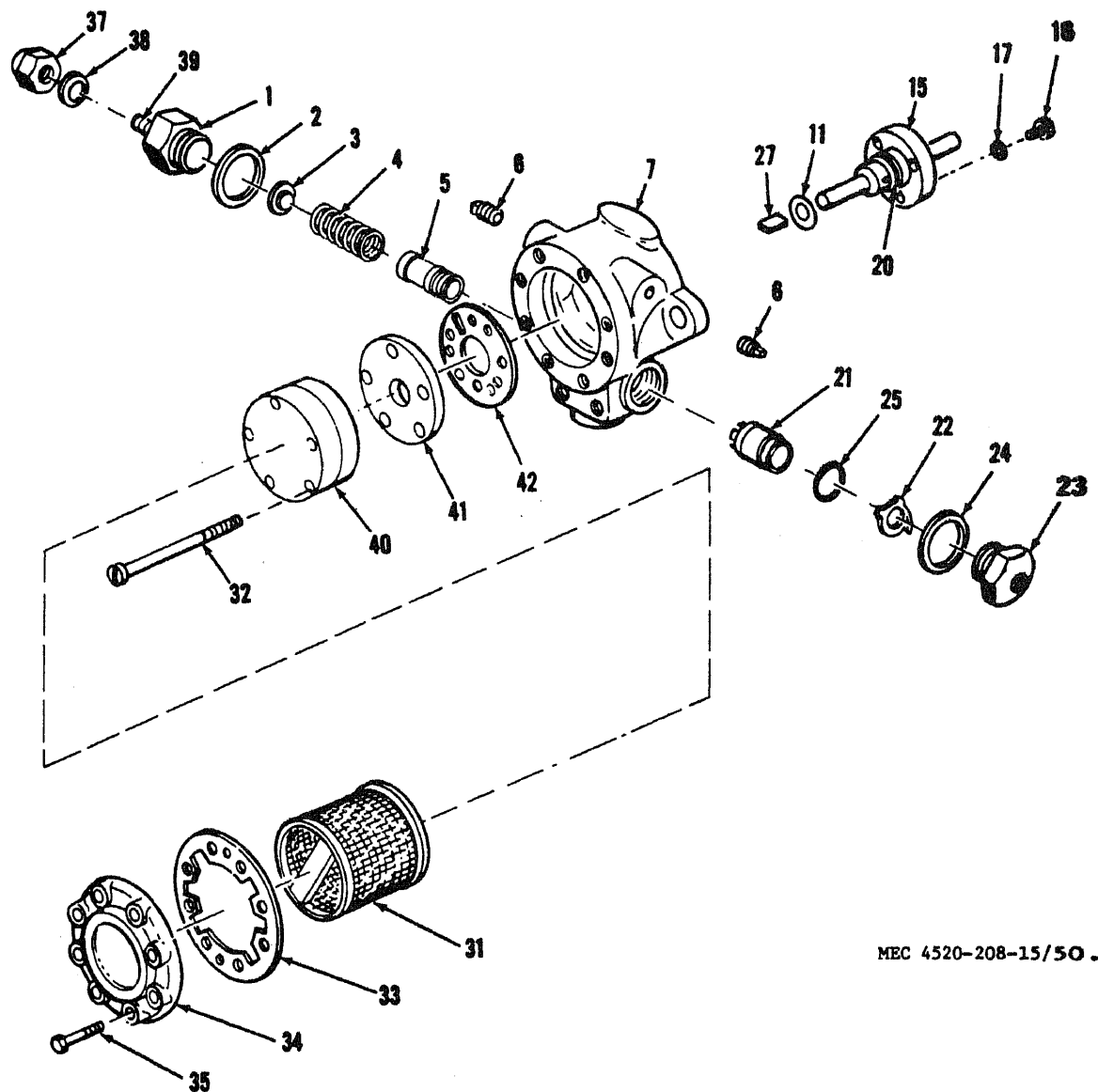
1. Carriage bolt (2) (BT400-40-1)
2. Removable bar, right hand (BT400-40-1)
3. Support bracket (2) (BT400-40-1)
4. Support stop, right hand (BT400-40-1)
5. Top door support, right side (BT400-40-1)
6. Screw, machine, No. 10-24 x 3/8 in. (13 rqr on BT400-40, 17 rqr on BT400-40-1)
7. Washer, lock, IT, No. 10 (15 rqr on BT400-40, 19 rqr on BT400-40-1)
8. Nut, plain, hex, No. 10-24 (13 rqr on BT400-40, 17 rqr on BT400-40-1)
9. Hinge support bracket (BT400-40-1)
10. Top door support, left side (BT400-40-1)
11. Nut, plain, hex (2) (BT400-40-1)
12. Bar assembly, left hand (BT400-40-1)
13. Fiber washers (2) (BT400-40-1)
14. Support stop, left hand (BT400-40-1)
15. Removable bar, left hand (BT400-40-1)
16. Upper bulkhead
17. Exhaust shield
18. Identification plate (BT400-40)
19. Rivet, blind, 1/8 x 3/16 in. (12)
20. Identification plate (BT400-40-1)
21. Pin, tapered, plain (2)
22. Bracket, Angle (BT400-40)
23. Support, exhaust pipe (BT400-40)
24. Gasket, exhaust pipe (BT400-40)
25. Exhaust pipe extension
26. Chain (2)
27. Master instruction plate
28. Adapter outlet cover
29. Casing
30. Bolt, machine, hex hd, 5/16-18 x 1/2 in. (10)
31. Washer, lock, IT, 5/16 in. (10)
32. Washer, flat, 5/16 in. (4)
33. Washer, special (4)
34. Lower bulkhead
35. Nut, plain, hex, 1/4-20 (3)
36. Washer, lock, 1/4 in. (3)
37. Publications case
38. Washer, lock, 1/4 in. (3)
39. Screw, cap, hex hd, 1/4-20 x 3/4 in. (3)
40. Skid cover
41. Left side panel
42. Washer, lock, IT, 1/4 in. (16 rqr on BT400-40, 19 rqr on BT400-40-1)
43. Screw, cap, hex hd, 1/4-20 x 1/2 (16 rqr on BT400-40, 19 rqr on BT400-40-1)
44. Identification plate (BT400-40-1)
45. Rivet (4) (BT400-40-1)
46. Latch (2)
47. Rivet, tubular (4)
48. Power unit support
49. Nut, self-locking, hex, No. 10-24 (8)
50. Right side panel
51. Grommet, rubber
52. Identification plate
53. Rivet (4)
54. Thumb screw (2)
55. Screw, machine, No. 10-24 x 1-5/8 in. (8)
56. Resilient mount (2 rqr)
57. Nut, 10-24 (4 rqr)
58. Capillary tube shield
59. Rivet, tubular
60. Washer, flat, No. 8
61. Exhaust stack cover
62. Gasket
63. Exhaust stack
64. Washer, flat, No. 8 (12)
65. Screw, Machine, No. 8-32 x 3/4 in. (12)
66. Exhaust pipe, w/out screen
67. Exhaust pipe, w/screen
68. Fuel system diagram instruction plate
69. Screw, cap, hex head 10-24 x 1/2 in. (2)
70. Screw, cap, hex head 10-24 x 1 in. (2)
71. Washer, No. 10 flat (8)
72. Exhaust flange
73. Screw, machine, No. 8-32 x 3/8 in. (4) (BT400-40-1)
74. Washer, lock, IT, No. 8 (4) (BT400-40-1)
75. Nut, plain, hex, No. 8-32 (4) (BT400-40-1)
76. Bar assembly, right hand (BT400-40-1)
77. Washer, No. 10, internal tooth (8)
78. Sleeve, exhaust pipe

Figure 49.1. Casing, bulkheads and power unit support, exploded view, Model BT400-40-5, Serial Nos. BT4400005 and subsequent.

Page 96. Change the caption of figure 50 to read: "Fuel pump, exploded view, Models BT400-40

and BT400-40-1."

Figure 50.1 and key is added as follows:



MEC 4520-208-15/50.1

1. End plug
2. Washer, nonmetallic (gasket)
3. Spring seat
4. Helical compression spring
5. Piston
6. Pipe plug, 1/4 NPT
7. Pump body
8. Deleted
9. Deleted
10. Deleted
11. Spring washer
12. Deleted
13. Deleted

14. Deleted
15. Bearing-shaft-and-seal assembly
16. Screw, machine, No. 10-32 x 1/2 in. (3)
17. Washer, lock, IT No. 10 (3)
18. Deleted
19. Deleted
20. Packing, preformed
21. Piston sleeve
22. Retainer sleeve
23. End plug
24. Washer, nonmetallic (gasket)

- 25. Packing, preformed
- 26. Deleted
- 27. Drive key
- 28. Deleted
- 29. Deleted
- 30. Deleted
- 31. Strainer
- 32. Screw, machine, No. 10-32 x 1-5/8 in. (5)
- 33. Gasket

- 34. Pump cover
- 35. Screw, cap, hex hd, 1/4-20 x 1-1/8 in. (8)
- 36. Deleted
- 37. End cap nut
- 38. Gasket
- 39. Adjusting screw
- 40. Plate assembly, end, with crescent, gears, ring and key
- 41. Port housing
- 42. Gasket

**Figure 50.1. Fuel pump, exploded view, Models BT400-40-1, Serial No's BT4400866 and subsequent.**

**Page 97, paragraph 155b.1** is added as follows:

**b.1. Disassembly.** (BT400-40-1, Serial No's BT4400866 and subsequent.)

(1) Remove eight screws (35, fig. 50.1) securing pump cover (34) to fuel pump (7) and remove pump cover, gasket (33) and strainer (31).

(2) Remove five screws (32) and remove rotor assembly (40).

(3) Remove drive key (27), roller and rotor from rotor housing. Examine parts and discard if defective.

(4) Remove port housing (41) and gasket (42).

(5) Remove three screws (16) and lockwashers (17) securing bearing-shaft-and-seal assembly (15) to pump body. Evenly pry bearing-shaft-and-seal assembly from pump body.

**NOTE**

Do not disassemble bearing-shaft-and-seal assembly. If faulty, replace the entire item (15) assembly.

(6) Remove end plug (1), washer (2), spring seat (3) and spring (4) from pump body.

(7) Remove end cap nut (37) and gasket (38) from adjusting screw end plug (1), and remove adjusting screw (39).

(8) Remove nozzle end plug (23), piston sleeve washer (22) and gasket (24) from pump body.

(9) Press the piston (5) and piston sleeve (21) out through the nozzle port end of the pump body. Remove and discard packing (25).

(10) Remove pipe plugs (6).

**Page 97, paragraph 155d.1** is added as follows:

**d.1. Assembly and installation.** (BT400-40-1, Serial No's BT4400866 and subsequent.)

(1) Install pipe plugs (6, fig. 50.1) in pump body (7).

(2) Install gasket (2) and adjusting screw end plug (1) in the pump body.

(3) Install new packing (25) on piston sleeve (21), coat the piston sleeve with MIL-L-2104A oil, and insert piston sleeve in pump body until sleeve contacts adjusting screw in end plug.

(4) Remove adjusting screw and end plug (1). Install the piston (5), piston spring (4), spring seat (3), gasket (2), and install adjusting screw end plug to secure parts.

(5) Position the piston sleeve washer (22) on the piston sleeve (21) and gasket (24) on nozzle end plug (23) and install end plug in pump body.

(6) Bottom adjusting screw, then turn out six full turns.

(7) Install gasket (42) on port housing (41) and position housing on pump body. Locate port housing to align mounting holes in housing with holes in pump body.

(8) Reassemble rotor in housing (40) and install drive key (27).

(9) Install rotor housing (40) and port housing (41) on pump body (7) using one screw. Install remaining four screws (31), leaving all five screws only hand tight.

(10) Install washer (43) in pump body.

(11) Coat packing (20) with MIL-G-10924 lubricant and install bearing-shaft-and-seal assembly in pump body while observing the following:

(a) Rotate shaft to ensure that drive key (27) engages slot in shaft.

(b) Ensure that bearing-shaft-and-seal assembly enters pump body evenly to prevent damage to packing (20) as it passes by bearing recess shoulder.

(12) Secure bearing-shaft-and-seal assembly using three screws (16) and washers (17), tightening each screw alternately, a little at a time, until all three screws are evenly torqued to 40 to 50 inch pounds.

NOTE

An electric drill can be connected to the pump shaft by flexible coupling to obtain shaft rotation as required in step 13.

(13) While the pump shaft is rotating, tighten each of the five screws (32) in a star pattern, a little each time, until all five are evenly torqued to 40 to 50 inch pounds and the pump shaft rotates freely.

(14) Position strainer (31), gasket (33) and pump cover (34) on the pump body (7), and secure with eight screws (35), torqued to 84 to 96 inch pounds.

(15) Install and adjust fuel pump (para 90).

*Page 100, paragraph 159b(1)* is superseded as follows:

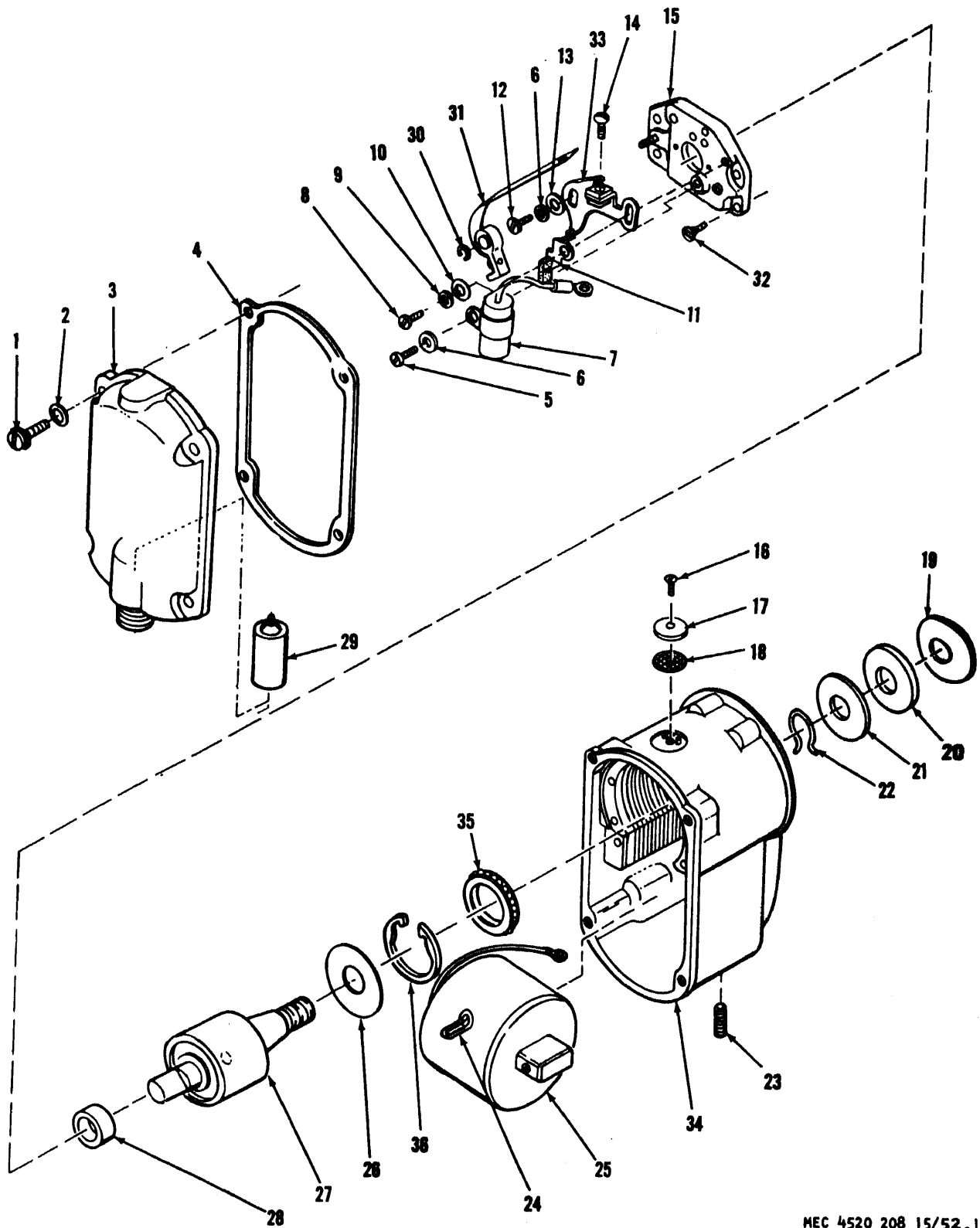
(1) Remove four screws (1, fig. 52 or 52.1) and lockwashers (2) and remove end cap (3) and gasket (4) from housing (34). Remove cable outlet (29) from end cap.

*Paragraph 159d(1)* is superseded as follows:

(1) Position the coil (25, fig. 52 or 52.1) in the housing (34) and secure with two setscrews (23). Insert ball bearing (35) in housing and secure with retaining ring (36).

*Page 101.* Change the caption of figure 52 to read: "Magneto, exploded view, Models BT400-40 and BT400-40-1."

Figure 52.1 and key are added as follows:





**TM 5-4520-208-15**

**C7**

- |   |  |
|---|--|
| 1. Screw, assembled, machine, No. 10-24 x 5/8 in. (4) | 20. Magneto packing                        |
| 2. Washer, lock, IT, No. 10 (4)                       | 21. Inner flat washer                      |
| 3. End cap  | 22. Retaining clip                         |
| 4. Gasket   | 23. Setscrew, 1/4-20 x 3/4 in. (3)         |
| 5. Screw, machine, No. 6-32 x 5/16 in.                | 24. Electrical contact                     |
| 6. Washer, lock, No. 6 (2)                            | 25. Magneto coil                           |
| 7. Capacitor, fixed                                   | 26. Cork bearing oil seal                  |
| 8. Screw, machine, No. 8-32 x 3/8 in.                 | 27. Magneto rotor                          |
| 9. Washer, lock, No. 8                                | 28. Sleeve bearing                         |
| 10. Washer, flat, No. 8                               | 29. Cable outlet                           |
| 11. Cam wick and holder                               | 30. Retaining ring                         |
| 12. Screw, machine, No. 6-32 x 3/8 in.                | 31. Breaker arm                            |
| 13. Washer, flat, No. 6                               | 32. Screw, machine, No. 8-32 x 3/8 in. (4) |
| 14. Screw, machine, No. 6-32 x 3/8 in.                | 33. Stationary support bracket             |
| 15. Rotor bearing support                             | 34. Housing                                |
| 16. Screw, machine, No. 6-32 x 5/16 in.               | 35. Ball bearing, annular                  |
| 17. Hood  | 36. Retaining ring                         |
| 18. Screen  |  |
| 19. Outer flat washer                                 |  |

*Figure 52.1. Magneto, exploded view, Model BT400-40-1, Serial No's BT4400866 and subsequent.*

By Order of the Secretary of the Army:

Official:

**J. C. PENNINGTON**  
*Brigadier General, United States Army*  
*The Adjutant General*

**BERNARD W. ROGERS**  
*General, United States Army*  
*Chief of Staff*

**Distribution:**

To be distributed in accordance with DA Form 12-25C, Operator maintenance requirements for Heaters,  
Space: 400,000 BTU.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS



# SOMETHING WRONG WITH THIS MANUAL?

THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

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PFC JOHN DOE  
COA, 3<sup>rd</sup> ENGINEER BN  
FT. LEONARD WOOD MO 63108

DATE 16 DEC 74

PUBLICATION NUMBER

TM5-6115-200-20 AND P

DATE

1 APR 72

TITLE

GENERATOR SET 10 KW  
NSN 6115-00-231-7286

BE EXACT...PIN-POINT WHERE IT IS

PAGE NO.

PARA-GRAPH

FIGURE NO.

TABLE NO.

6

2-1  
a

81

4-3

125 line 20

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.

Callout 16 on figure 4-3 is pointing at a bolt. In the key to fig. 4-3, item 16 is called a shim. Please correct one or the other.

I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered so the NSN is wrong. Please give me a good NSN.

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

JOHN DOE, PFC (268) 317-7111

SIGN HERE:

John Doe

DA FORM 2028-2 (TEST)

1 AUG 74

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PUBLICATION NUMBER

TM 5-4520-208-15

DATE

20 MAR 1967

TITLE HEATER, DUCT-TYPE, PORTABLE;

BE EXACT...PIN-POINT WHERE IT IS

IN THIS SPACE TELL WHAT IS WRONG  
AND WHAT SHOULD BE DONE ABOUT IT:

PAGE  
NO.

PARA-  
GRAPH

FIGURE  
NO.

TABLE  
NO.

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CHANGE }  
No. 8 }

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D.C., 29 June 1983

**Operator, Organizational, Direct and General  
Support and Depot Maintenance Manual**

**HEATER, DUCT-TYPE, PORTABLE, 400,000 BTU/HR; GASOLINE ENGINE  
AND ELECTRIC MOTOR-DRIVEN BLOWERS; W/6 AND 12-INCH DUCTS;  
AUTOMATIC TEMPERATURE CONTROL; TRAILER MOUNTED  
(AMERICAN AIR FILTER CO., INC. MODEL BT400-40)  
NSN 4520-00-792-8257 (MODEL BT400-40-1)  
NSN 4520-00-915-7789 (MODEL BT400-40-1A)  
NSN 4520-00-223-3221**

TM 5-4520-208-15, 20 March 1967, is changed as follows:

**Cover Page.** On the inside of the Cover Page, add the following warning:

**WARNING  
CARBON MONOXIDE**

Gasoline engine driven heaters should not be used for heating personnel areas, such as hospital wards, living quarters, etc. The period of continuous exposure for personnel in these areas will generally exceed eight (8) hours, and adequate fresh air supply may be limited or carbon monoxide contaminated.

These heaters may be used to heat warehouses and for maintenance shop applications, if the personnel exposure is limited to not more than eight hours and ventilation is adequate.

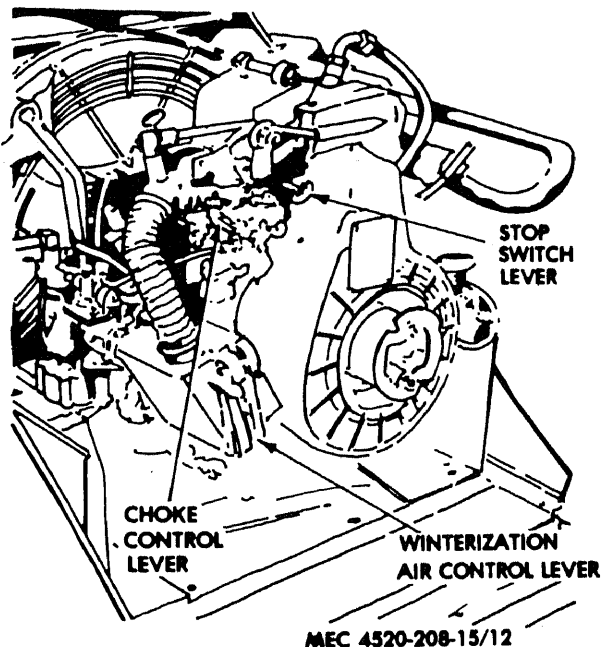
**Page 9.** Under Title "Installation and Operating Instructions", add the following warning:

**WARNING  
CARBON MONOXIDE**

Gasoline engine driven heaters should not be used for heating personnel areas, such as hospital wards, living quarters, etc. The period of continuous exposure for personnel in these areas will generally exceed eight (8) hours, and adequate fresh air supply may be limited or carbon monoxide contaminated.

These heaters may be used to heat warehouses and for maintenance shop applications, if the personnel exposure is limited to not more than eight hours and ventilation is adequate.

**Page 20.** Add modified illustration "Figure 12."



**Page 20, paragraph 22.** After paragraph 22, add paragraph 22.1 as follows:

22.1. Winterization Air Control Lever (Fig. 12). See TM 5-2805-256-14 for operation.

**Page 22, paragraph 32b(1).** Add the following sentence after "power unit."

See TM 5-2805-256-14 for operation of Winterization Air Control (Fig. 12).

*Page 23, paragraph 32d(2).* Add the following caution after (2):

**CAUTION**

On Model BT400-40 Heaters, frequent observation of fuel level is necessary to prevent fuel pump failure due to continuation of Heater, Electric Motor operation after fuel supply is exhausted.

*Page 24, paragraph 35a(1).* Add the following caution after (1):

**CAUTION**

On Model BT400-40 Heaters, frequent observation of fuel level is necessary to prevent fuel pump failure due to continuation of Heater, Electric Motor operation after fuel supply is exhausted.

*Page 24, paragraph 35a(4).* Add the following sentence after "heater controls."

By Order of the Secretary of the Army:

Official:

ROBERT M. JOYCE  
Major General, United States Army,  
The Adjutant General

**DISTRIBUTION:**

To be distributed in accordance with DA Form 12-25C, Operator Maintenance requirements for Heater Space: 400,000 BTU.

See TM5-2805-256-14 for operation of Winterization Air Control (Fig. 12).

*Page 26, paragraph 36e.* Add the following sentence after "frequent intervals."

Utilization of Funnel with a strainer will afford the necessary protection to prevent fuel contamination during refueling operations.

*Page 48, paragraph 78a and b.* Change the second word in each of the paragraphs from "gages" to "gases".

*Page 57, Figure 34.* Change item 26 to the following:

Control Valves and Block (fig 51)

*Page 114, Figure 54.* Add Item 10. Fire extinguisher. Change items 10 thru 14 to items 1 thru 15.

E. C. MEYER  
General, United States Army  
Chief of Staff

TECHNICAL MANUAL  
No. 5-4520-208-15

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D. C., 20 March 1967

**Operator, Organizational, Direct and General  
Support and Depot Maintenance Manual  
For  
HEATER, DUCT TYPE, PORTABLE  
400,000 BTU/HR  
MODELS BT400-40 AND BT400-40-1  
FSN 4520-792-8257 AND FSN 4520-930-9474**

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## CHAPTER 1

### INTRODUCTION

---

#### Section I. GENERAL

##### 1. Scope

a. These instructions are published for the use of personnel to whom the American Air Filter Model BT400-40 and BT400-40-1 Heaters (figs. 1 and 2) are issued. Chapters 1 through 4 provide information on the operation, preventive maintenance services, and organizational maintenance of the equipment, accessories, components, and attachments. Chapters 5, 6, and 7, provide information for direct support, general support, and depot maintenance. Also included are descriptions of main units and their functions in relationship to other components.

b. Appendix I contains a list of publications applicable to this manual. Appendix II contains the Maintenance Allocation Chart. Appendix III contains the list of Basic Issue Items authorized the operator of this equipment. The Organizational, Direct and General Support, and Depot Maintenance Repair Parts and Special Tools are listed in TM 5-4520-208-25P.

c. Numbers in parentheses on illustrations indicate quantity. Numbers preceding nomen-

clature callouts on illustrations indicate the preferred maintenance sequence.

d. The front of the heater is the basket end. The rear of the heater is the outlet end. Left and right are defined as facing the outlet end of the heater.

e. The direct reporting of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended Changes to DA Publications) will be used for reporting these improvements. This form will be completed using pencil, pen, or typewriter and forwarded direct to the Commanding General, U. S. Army Mobility Equipment Command, ATTN: AMSME-MPD, 4300 Goodfellow Blvd., St. Louis, Mo. 63120

f. Report all equipment improvement recommendations as prescribed by TM 38-750.

##### 2. Record and Report Forms

For record and report forms applicable to the operator, crew, and organizational maintenance, refer to TM 38-750.

*Note.* Applicable forms shall be kept in a canvas case mounted on the equipment.

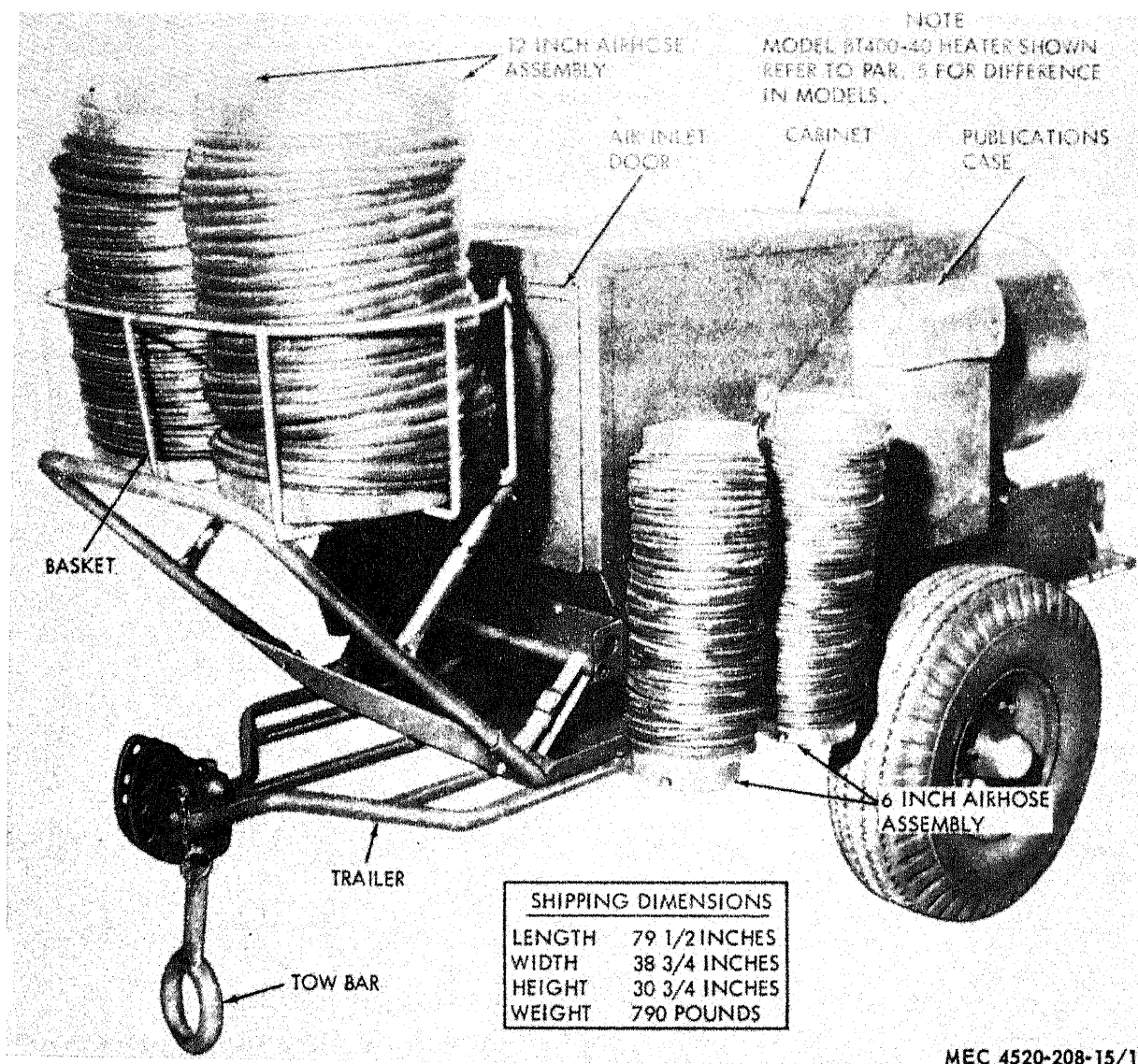
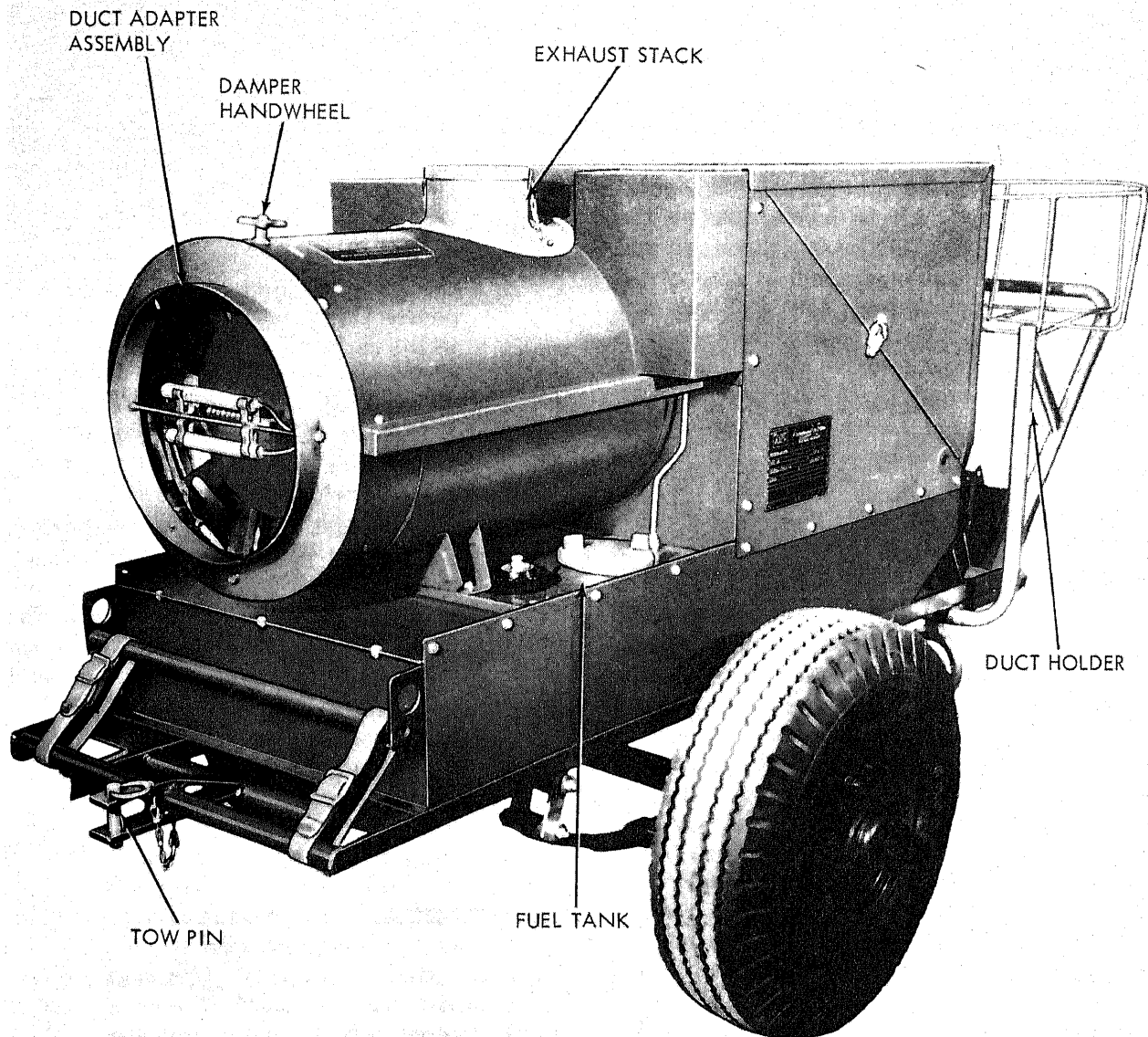


Figure 1. Heater, three-quarter left front view.



MEC 4520-208-15/2

Figure 2. Heater, three quarter right rear view.

## Section II. DESCRIPTION AND DATA

### 3. Description

a. *General.* The heater, (fig. 1), is a fully inclosed, portable, trailer mounted unit, intended primarily for use in ground heating

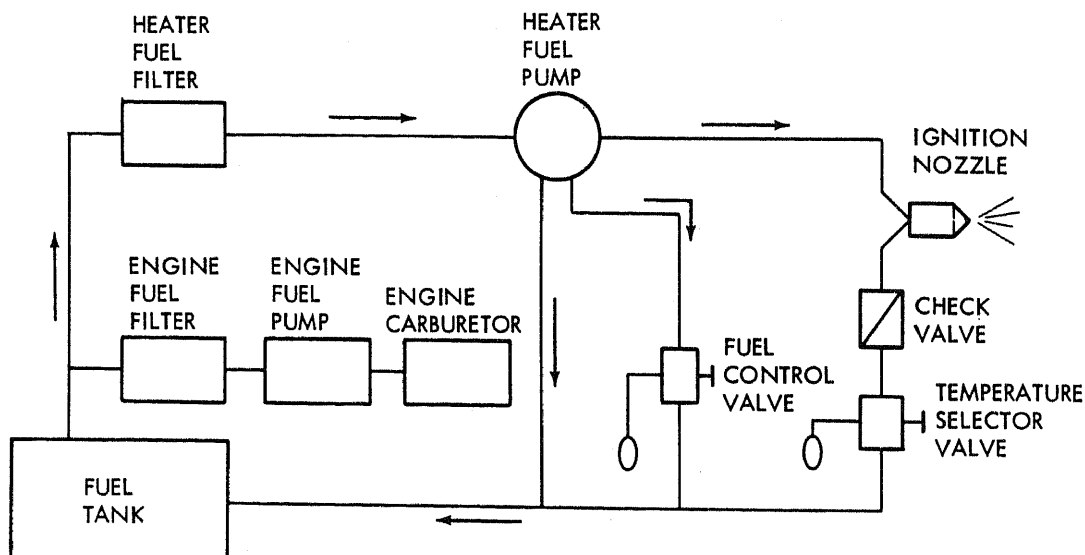
aircraft engines and fuselages, and secondarily, for use in ground heating maintenance shelters, portable hangers and other similar inclosures.

b. *Power Units.* The Model BT400-40 heater is supplied with two power units: one is a Military Standard gasoline engine, Model 1A08-III; the other a 2-horsepower, 208-220 volt, 60-cycle, 3-phase alternating current electric motor. The Model BT400-40-1 heater is supplied with only the Military Standard gasoline engine, Model 1A08-III. Each power unit supplies all the air necessary for operation of the heater. Air is drawn through the air inlet door (fig. 1), passes through and around the heat exchanger, and is discharged through ducts mounted on the duct adapter assembly (fig. 2). Both power units have a coupling attached to the drive shaft. The drive coupling is connected to the driven coupling by a flexible rubber sleeve which mates the two. The driven coupling drives the heater fan and, through a pulley which is an integral part of the driven coupling, a V-belt. The belt drives the fuel pump mounted on the right side and the heater ignition magneto on the left side of the power unit.

c. *Fuel System.* The fuel system, figure 3, supplies gasoline to the heater and to the

gasoline engine power unit when the engine is used to drive the heater.

- (1) *Fuel tank.* The 16-gallon fuel tank is suspended by straps in the base of the heater and is removable. Fuel is drawn from the tank through automotive-type filters and delivered to the gasoline engine power unit and the heater fuel pump.
- (2) *Engine fuel system.* Fuel from the tank is drawn through the filter by the engine fuel pump. The fuel passes through the engine fuel filter to the carburetor and is ignited by the engine. A quick-disconnect coupling is supplied on the fuel line at the engine fuel filter inlet line to facilitate removal of gasoline engine.
- (3) *Heater fuel pump.* The belt-driven heater fuel pump draws fuel through the filter and delivers fuel at a constant high pressure to the nozzle. The pump operates continuously when power unit is in operation. Unused



MEC 4520-208-15/3

Figure 3. Fuel system, schematic diagram.

fuel is bypassed at the pump or at the nozzle and returned to the fuel tank. The pump has three outlets. If the primary bypass line is closed by the fuel control valve, fuel flows to the nozzle, and also through the secondary bypass line to the fuel tank. When the fuel control valve is open, the pump cannot build up sufficient pressure to open the balanced pump valve. There is always flow through the secondary bypass line as the fuel pump supplies fuel in excess of nozzle capacity.

- (4) *Fuel control valve.* Pushing the knob down closes the fuel control valve (fig. 11) and fuel flows to the nozzle. The fuel control valve also acts as an overheat valve. A heat sensing element is located in the heater discharge air stream. When the air temperature exceeds 330°F to 350°F the fuel control valve will open, lowering the pressure, and fuel will not flow to the nozzle.
- (5) *Nozzle.* The nozzle (fig. 35) is contained within the nozzle holder. On Model BT400-40 heaters the inlet and bypass fuel lines are an integral part of the nozzle holder. Fuel flows through the nozzle and is atomized. As the fuel leaves the nozzle it is ignited by the igniter plug in the combustor. Fuel is also bypassed from the nozzle, through a check valve, to the temperature selector valve on the control panel. The check valve prevents a reverse flow of fuel to the nozzle.
- (6) *Temperature selector valve.* The temperature selector valve (fig. 11) allows the operator to select the temperature of the discharge air. When the knob is turned, a pinion gear turns the temperature indicator knob. The indicator knob pointer indicates the discharge air temperature selected, from 150°F to 280°F. Fuel flowing through the temperature selector valve is restricted to raise the pressure at

the nozzle, forcing more fuel through the nozzle orifice and raising the temperature. As the temperature of the discharge air reaches the selected heat, the heat sensing element of the temperature selector valve will open the restriction and bypass more fuel. Pressure drops at the nozzle and heat output settles to the setting selected.

*d. Heat Exchanger.* Fuel flowing from the nozzle is ignited in the combustor. The burning fuel strikes a plate or target in the combustor and is diffused into the heat exchanger. Air from the fan enters holes in the side of the combustor in a manner that will ensure proper fuel-air mixture. From the combustor, the burning fuel flows through the heat exchanger in a spiral path between the surfaces of the ventilating air tubes and is expelled through the exhaust opening at the top of the casing. Ventilating or heating air is forced through the parallel tubes and the space between the heat exchanger shell and the casing. Heat is exchanged between the hot exhaust gases and the ventilating air. At the discharge end of the heat exchanger are the temperature sensing elements. The air control assembly consists of a baffle, a series of radial tubes, and an adjustable damper. Air traveling between the walls of the heat exchanger and the casing is directed radially inward behind the baffle where it is mixed with warmer air leaving the parallel tubes of the heat exchanger. This mixing insures a more uniform temperature throughout the the discharge air stream. The shutter is controlled by a damper control which is locked by a handwheel mounted in a slot above the discharge end of the heater. The damper is used to reduce the heat output, without reducing the air volume. Volume can be set between full and one-half of full volume. A duct adapter assembly is installed on the discharge end of the heater to connect the flexible air hose as shown in figure 9.

*e. Cabinet.* The power unit end of the heater is inclosed in a cabinet (fig. 1) which affords protection against the elements and prevents damage during storage or transit.

The cabinet on Model BT400-40 heaters is removable and retained by spring-loaded latches. On Model BT400-40-1 heaters, the cabinet is hinged and is provided with cabinet supports. When the heater is in operation the air inlet door (fig. 1) of the cabinet must be open to allow air flow. The control box on the right of the heater has a hinged cover which opens to allow access to the controls. Access to the power unit and all other controls may be gained by removing the cabinet.

f. *Trailer.* A two-wheeled trailer is provided to transport the heater when moving from worksite to worksite. Duct holders (figs. 1 and 2) hold the six-inch air hose when they are not in use. The 12-inch air hose and duct adapter are stored in the basket (fig. 1). An adjustable tow bar (fig. 1) serves as a support when the trailer is at rest. Several trailers can be towed in tandem by attaching the tow bar to the tow pin (fig. 2) of the preceding trailer.

#### 4. Identification

a. *General.* The Model BT400-40 and B400-40-1 heaters have eight identification and instruction plates. The information contained on these plates is listed below:

##### b. *Heater (Model BT400-40).*

(1) *Corps of Engineer plate.* Located on top of the exhaust pipe shield and contains the following information.

- (a) Nomenclature.
- (b) Stock number.
- (c) Serial number.
- (d) Manufacturer and model number.
- (e) Contract number and date manufactured.
- (f) Dimensions, weight, and capacity.
- (g) Engine manufacturer, model, and serial number.

(2) *Manufacturer's identification plate.* Located on the right side panel and contains the following information:

- (a) Nomenclature.
- (b) Part number and serial number.
- (c) Federal stock number and contract number.
- (d) Rating.

(3) *Trailer identification plate.* Located on the right side of the trailer and contains the following information:

- (a) Trailer type, stock number, and serial number.
- (b) Manufacturer's name and address.
- (c) Part number, contract number, and date manufactured.
- (d) Weight.

(4) *Electric motor identification plate.* Located on the electric motor housing, and contains the following information:

- (a) Number of phases, voltage, and amperage.
- (b) Type and frame.
- (c) Horsepower and frequency.
- (d) Revolutions per minute, code, and service factor.
- (e) Motor model number.

##### c. *Heater (Model BT400-40-1).*

(1) *U.S. Army identification plate.* Located on the side of exhaust pipe shield and contains the following information:

- (a) Nomenclature.
- (b) Model and contract number.
- (c) Serial number and capacity.
- (d) Dimensions and weight.
- (e) Federal stock number and date manufactured.
- (f) Engine serial number.
- (g) Warranty information and manufacturer.

(2) *Manufacturer's identification plate.* Located on the left side panel and contains the information listed in paragraph b(2) above.

(3) *Trailer identification plate.* Located on the right side of the trailer frame and contains the following information.

- (a) Manufacturer's name and address.
- (b) Trailer type, Federal stock number, and serial number.
- (c) Part number, contract number, and weight.

- (4) *Danger plate.* Located on the left side panel and contains the following information:

**DANGER: THIS UNIT UNSAFE  
IN FUEL VAPOR  
AREAS**

*d. Identification Applicable to Both Models.*

- (1) *Instruction plate.* Located on top of the casing, lists the operational steps to be observed by the operator.
- (2) *Gasoline engine identification plate.* Located on the engine flywheel housing and contains the following information:
  - (a) Nomenclature.
  - (b) Number of cylinders and displacement.
  - (c) Stock number, serial number, and Military model number.
  - (d) Manual number.
  - (e) Manufacturer, date manufactured, and purchase order number.
- (3) *Schematic diagram plate.* Located on the casing forward of the fan ring. Provides a schematic diagram of the heater fuel system.
- (4) *Power package identification plate.* Located on the power unit bracket and contains the following information:
  - (a) Manufacturer's name and address.
  - (b) Class and Federal stock number.

## 5. Difference in Models

This manual covers the American Air Filter Models BT400-40 and BT400-40-1 heaters. The major differences between the models are the fuel system, cabinet, and housing. The combustor fuel lines in the BT400-40 are replaced with flexible hose in the BT400-40-1 heater. The BT400-40 heater has a disposable automotive type filter, whereas the BT400-40-1 has a cleanable filter element. In Model BT400-40-1 heaters, the cabinet is hinged to the casing bulkhead and removal for operation of the heater is not required. In addition, the electric motor power unit and time totalizing meter are not furnished with the Model BT400-40-1 heater. Where differences exist, each model is covered separately or coded as to application

in the applicable maintenance section of this manual.

## 6. Tabulated Data

### *a. Data Applicable to Model BT400-40 Heaters.*

#### (1) Heater.

Nomenclature.....	Heater, Duct Type Portable
Stock number.....	FSN 4520-792-8257
Serial numbers.....	90943 through 91924, 91032 through 91446, and 91694 through 91748
Manufacturer.....	American Air Filter Co., Inc., Defense Products Group
Model number.....	BT400-40
Contract numbers.....	DA-11-184-AC-601 (T) DA-11-184-AMC-702 (T)
Fuel.....	Gasoline
Fuel consumption.....	3.825 gph (gallons per hour) at maximum out- put based on -65°F. (fahrenheit) ambient temperature, 280°F. discharge temperature
Output.....	40,000 to 400,000 Btu/hr (British thermal units per hour)
Discharge air temperature	150°F. to 280°F. range.

#### (2) Electric Motor

Manufacturer.....	Doerr Electric Corp.
Model number.....	66684ZA
Operating voltage.....	208 to 220
Cycles.....	60
Phase.....	3
Frame.....	K56Y (NEMA 56)
Type.....	PF
Current.....	Alternating
Horsepower.....	2 at 3450 rpm (revolutions per minute)
Running current .....	6.0 amperes maximum
Line current.....	45 amperes at -65°F. (-54°C.) (centigrade)

#### (3) Fuel filter.

Manufacturer.....	Delux Products Corp.
Part number.....	FF332
Type.....	Disposable

#### (4) Tires.

Size.....	6.00 x 9
Ply.....	6
Pressure.....	20 psi (pounds per square inch)



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*b. Data Applicable to Model BT400-40-1 Heaters.*

*(1) Heater.*

Nomenclature.....Heater, Duct Type, Portable  
 Stock number.....FSN 4520-930-9474  
                                   BT4400001 and subsequent  
 Manufacturer.....American Air Filter Co.,  
                                   Inc., Defense Products  
                                   Group  
 Model number.....BT400-40-1  
 Contract number.....DA-23-195-AMC-  
                                   01008(T)  
 Fuel.....Gasoline  
 Fuel consumption.....3.825 gph at maximum  
                                   output based on -65°F.  
                                   ambient temperature,  
                                   280°F. discharge  
                                   temperature  
 Output.....40,000 to 400,000 Btu/hr.  
 Discharge air temperature 150°F. to 280°F.

*(2) Fuel Filter.*

Manufacturer.....Klemm Automotive  
                                   Products Co.  
 Part number.....JR-82 Special  
 Type.....Replaceable element  
 Element part number.....CE-102 Special

*(3) Tires.*

Size.....6.00 x 9  
 Ply.....6  
 Pressure.....20 psi

*c. Data Applicable to Both Models.*

*(1) Engine.*

Make.....Military Standard Engine  
 Model.....1A08-III  
 Cylinders.....1

Cooling.....Air Cooled  
 Cycle.....4  
 Governed speed.....3600 rpm  
 Horsepower.....1.50 at 3600 rpm  
 Bore.....2.250 in. (inch)  
 Stroke.....2 in.  
 Displacement.....8.0 cu. in. (cubic in)  
 Ignition point setting.....0.016 to 0.020 in.  
 Fuel consumption.....0.7 gph

*(2) Fuel pump.*

Manufacturer.....Sundstrand Machine Tool  
                                   Company, Hydraulic  
                                   Division  
 Model.....J6BC-312-2

*(3) Heater magneto.*

Manufacturer.....Fairbanks Morse Co.  
 Model.....FMXE1B88B  
 Point setting.....0.015 to 0.018 in.  
 Voltage generated.....2500 volts at 2000 rpm

*(4) Igniter plug.*

Point setting.....0.1250 to 0.1876 in.

*(5) Tubes.*

Size.....6.00 x 9

*(6) Fuel tank.*

Capacity.....16 gal. (gallon)

*(7) Dimensions and weight.*

Overall length.....78 in.  
 Overall height.....39 in.  
 Overall width.....40 in.  
 Weight.....445 lb (pounds)  
 Shipping cubage.....70.3 cu ft. (cubic feet)

*(8) Fan data.*

Output.....810 cfm at 1 in. W. G. at  
                                   3600 rpm at -65°F.

## CHAPTER 2

### INSTALLATION AND OPERATING INSTRUCTIONS

#### Section I. SERVICE UPON RECEIPT OF EQUIPMENT

#### 7. Unloading Equipment

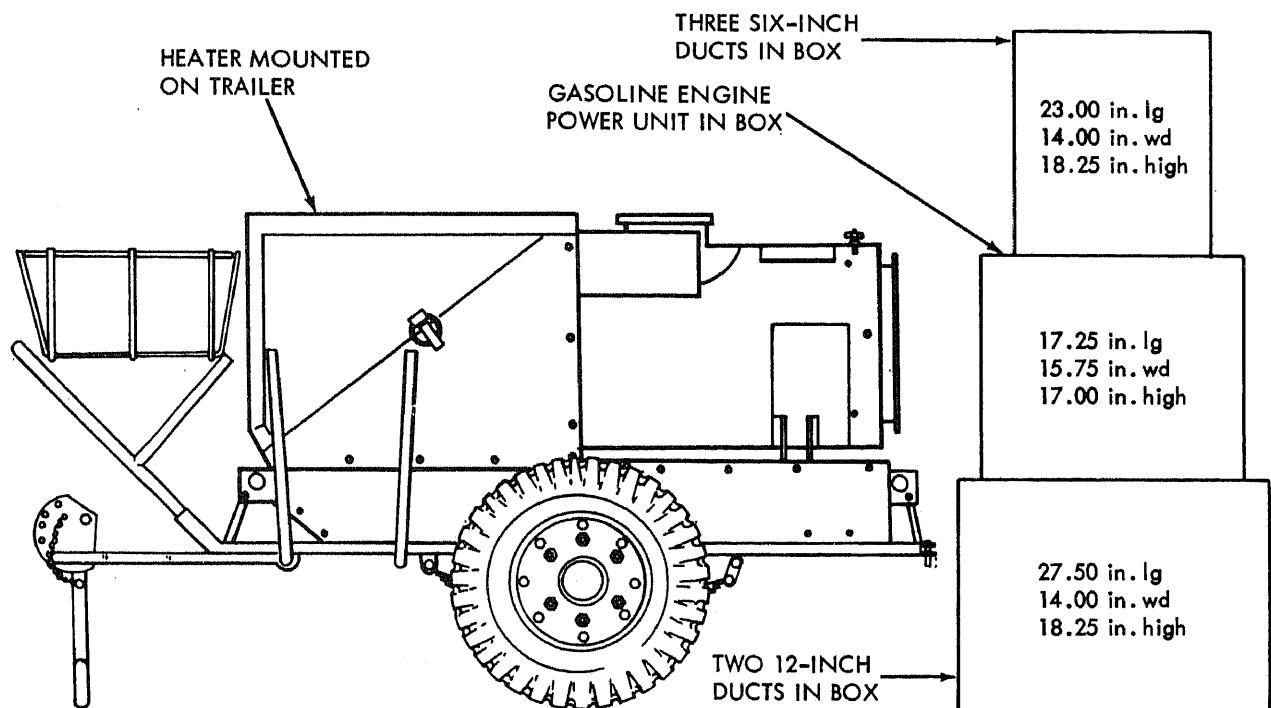
*a. General.* The BT400-40 and BT400-40-1 heaters may be received as towaway items or in wood shipping crates. Instructions provided in this section will cover either mode of shipment.

*b. Uncrated Equipment.*

- (1) The heater is shipped assembled (fig. 4). On Model BT400-40 heaters the

electric motor power unit is installed. The gasoline engine power unit is shipped packed in a separate cardboard box.

- (2) The flexible air hose and the duct adapters are shipped packed in two separate cardboard boxes.



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Figure 4. Heater shipping details.

*c. Crated Equipment.*

- (1) The heater is shipped, partially disassembled, in a wood packing crate (fig. 5).
- (2) Remove all tiedowns and blocks securing packing crate to carrier.
- (3) Use cable slings and hoist, or a fork-lift truck with a capacity of 1,000 pounds to lift heater from the carrier.

## 8. Unpacking New Equipment

*a. Uncrated Equipment.*

- (1) Remove exhaust stack extensions which are shipped unmounted and located inside the cabinet above the power unit.
- (2) Open all cardboard boxes and check contents against packing list.

*b. Crated Equipment.*

**Caution:** Be careful when using crowbars, pinch bars, and hammers while uncrating the equipment to prevent damage to the heater.

- (1) Remove packing crate top (1, fig. 5) by cutting reinforcement bands (6) and remove nails.
- (2) Remove trailer frame (2) from packing crate top.
- (3) Pry off ends and sides of packing crate.

**Caution:** On Model BT400-40 heaters be especially careful when removing cardboard boxes from packing crate. Do not drop box containing electric motor power unit.

- (4) Remove wheels (3), basket (8) and cardboard boxes (7) from packing crate.
- (5) Remove tiedowns and blocks securing heater (5) to packing crate bottom.
- (6) Remove exhaust stack extensions which are shipped unmounted and located inside the cabinet.
- (7) Open the cardboard boxes and check to see that they contain the following:
  - (a) Two 12-inch air hose assemblies.
  - (b) Three 6-inch air hose assemblies.
  - (c) Duct adapter.

(d) On Model BT400-40 heaters, Electric motor power unit.

- (8) Retain packing crate for reuse unless otherwise directed.

## 9. Removal of protective Material and Devices

*a. Location.*

- (1) The doors on the cabinet, the engine exhaust extension, the air cleaner, and the exhaust plug are sealed with cloth tape.
- (2) On Model BT400-40 heaters, the vent on the electric motor is sealed with cloth tape.
- (3) Each of the cardboard boxes contain barrier bags.
- (4) Preservative oil has been added to the engine crankcase.
- (5) Anticorrosion compound has been added to the fuel tank and fuel system.

*b. Removal.*

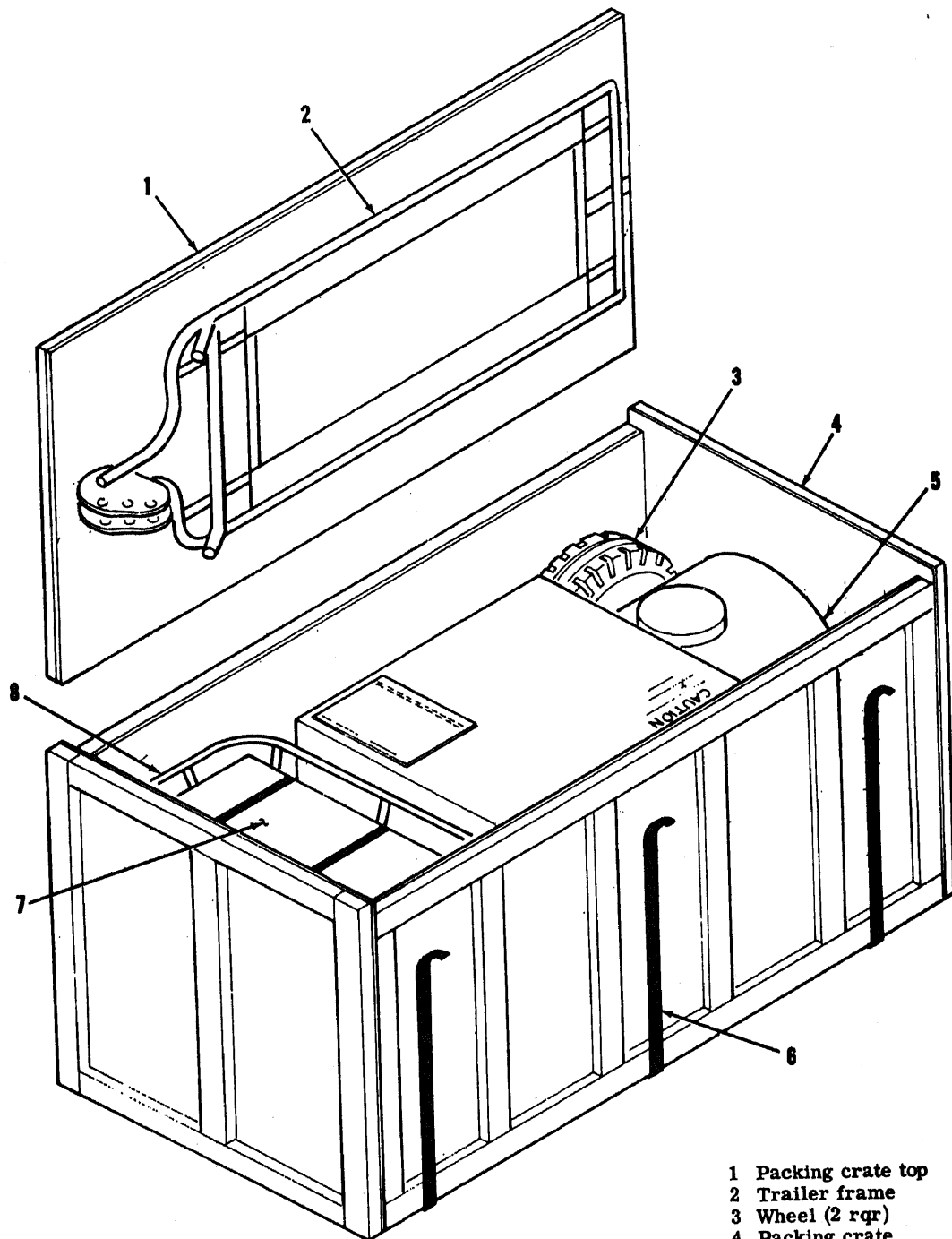
- (1) Remove cloth tape from cabinet door, engine exhaust extension and exhaust tube plug, and the bottom of the air cleaner.
- (2) On Model BT400-40 heaters, remove cloth tape from vent on the bottom front section of the electric motor.
- (3) Remove gasoline engine power unit from cardboard box and drain preservative oil from engine crankcase. Fill with the proper grade of oil as specified in the current lubrication order.
- (4) Fill fuel tank (para 10).

## 10. Inspection and Servicing of Equipment

*a. Tires.* Inspect the tires for leaking valves, cuts, or improper inflation.

*b. Trailer Frames and Cabinet.* Inspect the trailer frame and cabinet for broken welds, dents, and loose or missing hardware. Inspect the cabinet to see that no damage has occurred during shipment. Inspect to see that the air inlet door has not been sprung or the door and hinges are not bent or torn from the fastening.

*c. Power Units.* Inspect gasoline engine power unit for exterior damage and loose or missing parts. Set the stop switch lever to OFF



- 1 Packing crate top
  - 2 Trailer frame
  - 3 Wheel (2 rqr)
  - 4 Packing crate
  - 5 Heater
  - 6 Reinforcement band
  - 7 Cardboard box
  - 8 Basket
- MEC 4520-208-15/5

Figure 5. Heater packing details.

and turn the gasoline engine power unit over several times with the starter rope to see whether the engine turns freely. On Model BT400-40 heaters, inspect electric motor power unit for exterior damage and loose or missing hardware. Rotate the shaft of the electric motor power unit to see whether the rotor moves freely. See figure 6.

*d. Heater.* Inspect the igniter plug for broken or cracked insulator.

*e. Fuel Tank.* Inspect the fuel tank (fig. 2) for breaks or dents.

*f. Inspecting Used Equipment.* Special attention must be given to indications of more than normal wear. Give particular attention to tube assemblies for damage and leaks. Check all controls and gages for proper connections. Note any damage and report to direct support maintenance.

*g. Servicing Used Equipment.* Service the engine fuel filter (para 48) and start the heater and check all controls and gages for proper operation.

*h. Correcting or Reporting Deficiencies.* Correct all deficiencies noticed or report them to direct support maintenance.

*i.* Perform the before-operation services (para 43).

*j.* Perform the daily preventive maintenance services (para 44).

*k.* Lubricate the heater in accordance with the current lubrication order.

**Warning:** When filling the fuel tank, do not smoke or use an open flame in the vicinity. Always provide a metal-to-metal contact between the container and the tank. This will prevent a spark from being generated as the gasoline flows over the metallic surfaces.

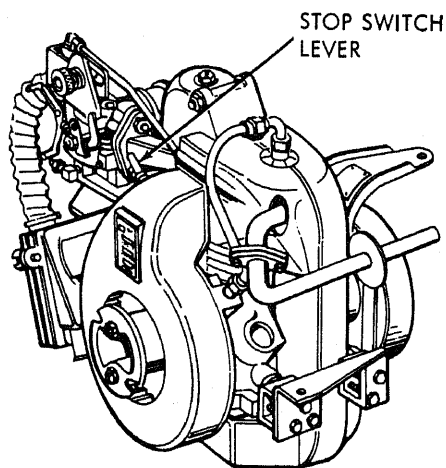
*l.* Fill the fuel tank with the proper grade of gasoline.

## 11. Installation of Separately Packed Components

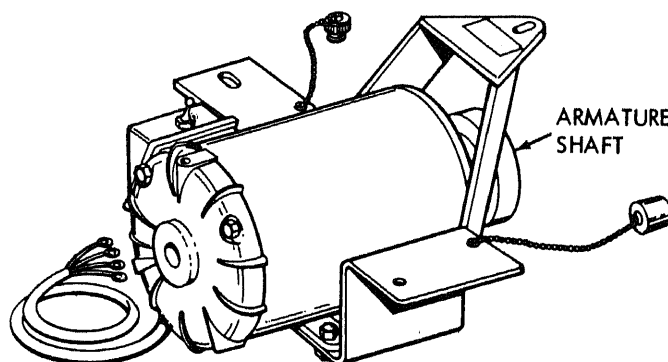
*Note.* If heater was received assembled (para 7b.), omit steps a. through f. below.

*a. Springs, Axle, and Wheels.*

- (1) Position wheel assembly (5, fig. 17) on hub (9) and secure by installing five ribbed shoulder bolts (1, fig. 44), lockwashers (10), and nuts (11). Install the other wheel in the same manner.



MILITARY STANDARD  
ENGINE MODEL 1A08-III  
GASOLINE ENGINE  
POWER UNIT



ELECTRIC MOTOR  
POWER UNIT

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Figure 6. Power units, mounting brackets.

- (2) Secure spring assembly (19) to axle assembly (15) by loosely installing two U-bolts (20), plate (16), four lockwashers (17), and four nuts (18). Secure the other spring in the same manner.
- (3) Position two shackles (24) on rear of spring assembly (19) and secure by installing shackle bolt (26), slotted hex nut (21), and cotter pin (22). Install the remaining two shackles to the other spring in the same manner.
- (4) Place trailer frame (21, fig. 45) on blocks to provide an 18-inch clearance from the ground.
- (5) Position assembled axle, wheels, and springs under trailer frame and secure by installing four shackle bolts (26, fig. 44), slotted hex nuts (21), and cotter pins (22). Install lubrication fitting (25) in each shackle bolts (26).
- (6) Tighten two hex nuts (18) on each of the four U-bolts (20) installed in paragraph (2) above.

*b. Tow Bar and Lock Pins.*

- (1) Install two chains connected to pins (13 and 18, fig. 45) on trailer frame (21) and secure with two screws (12) and lockwashers (11).
- (2) Position tow bar (22) on trailer frame and secure by installing screw (23) and nut (7).
- (3) Secure tow bar in desired position by installing pin (13). Remove blocking

*c. Heater Assembly (BT400-40).* Position the heater assembly on trailer frame (21), with the discharge end facing the rear, and secure by installing four straps (19).

*d. Heater Assembly (BT400-40-1).* Position the heater assembly on trailer frame with the discharge end facing the rear. Secure heater assembly to trailer frame using eight capscrow (21, fig. 39) and self-locking nuts (24).

*e. Duct Holders.* Position duct holder (14, fig. 45) trailer frame (21) and secure by installing screw (10), washer (9), and nut (8). Install the two remaining duct holders (14) in the same manner.

*f. Handle and Basket.*

- (1) Assemble and position the three sections of the trailer handle (3, 6, and 26) on the front of trailer frame (21).
- (2) Position snow shield (24) on trailer frame (21).
- (3) Secure snow shield and handle by installing two screws (10), washers (9) and nuts (8).
- (4) Place basket (1) on handle and secure by installing four U-bolts (2), lockwashers (5) and nuts (4).

*g. Flexible Air Hose.*

- (1) Remove three 6-inch air hose from cardboard container and position on duct holders (fig. 2).
- (2) Remove two 12-inch air hose and duct adapter from cardboard container and place in basket (fig. 1).

## 12. Equipment Conversion

*a. General.* The BT400-40 heater is equipped with two power units. Depending on the source of power, either the gasoline engine power unit or the electric motor power unit can be used to drive the heater. The electric motor power unit is also available on an as required basis for operation of the BT400-40-1 heater. The instructions contained in the following paragraphs are applicable on both models.

*b. Gasoline Engine Power Unit.*

*(1) Removal*

- (a) On Model BT400-40 heaters, remove cabinet (fig. 1) by disengaging two latches.
- (b) On Model BT400-40-1 heaters, disengage cabinet latches and open cabinet (fig. 1).
- (c) Remove three thumb screws (fig. 7) securing gasoline engine power unit to resilient mounts.
- (d) Disconnect engine fuel line quick-disconnect coupling (fig. 7) at engine fuel filter.
- (e) Pull gasoline engine power unit back from heater to disengage exhaust pipe and flexible rubber sleeve from drive coupling attached to engine power unit crankshaft.

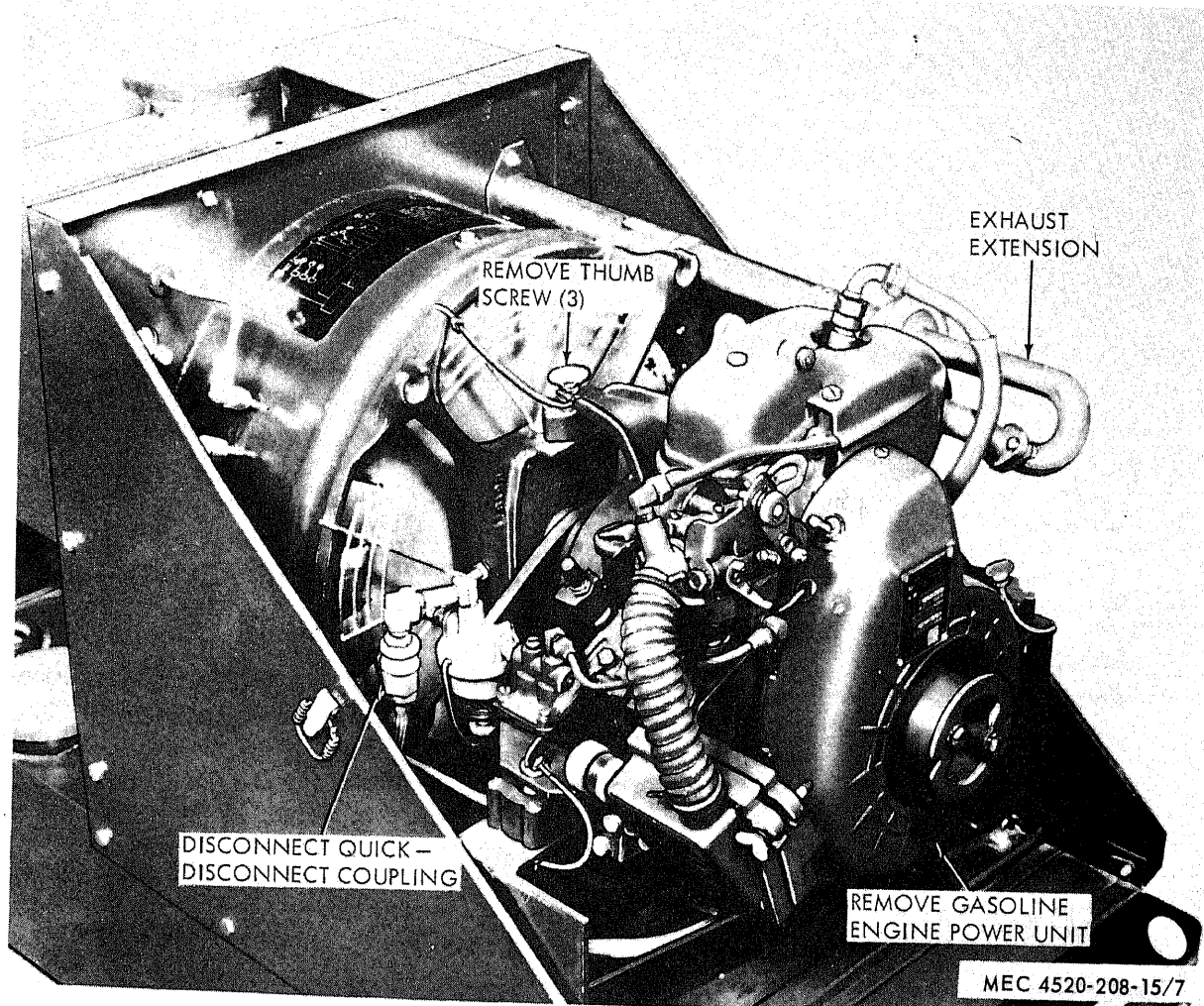


Figure 7. Gasoline engine power unit, installed view.

- (f) Remove engine power unit, with attached mounting brackets, from heater.
- (2) *Installation.*
  - (a) With cabinet removed or open, position gasoline engine power unit (fig. 7) on heater. Slide engine exhaust extension into exhaust pipe and engage drive coupling with flexible rubber sleeve. Aline holes in mounting brackets with holes in resilient mounts.
  - (b) Secure engine power unit in position with three thumb screws (fig. 7). Tighten thumb screws finger tight.
  - (c) Connect hose assembly to fitting on engine power unit fuel filter with quick-disconnect coupling (fig. 7).
  - (d) On Model BT400-40 heaters, install cabinet to inclose power unit and secure cabinet with latches.
  - (e) On Model BT400-40-1 heaters, close cabinet to inclose power unit and secure cabinet with latches.
- c. *Electric Motor Power Unit.*
  - (1) *Removal.*
    - (a) Disconnect electric cable (fig. 8) from power source.
    - (b) On Model BT400-40 heaters, remove cabinet (fig. 1) by disengaging two latches.

- (c) On Model BT400-40-1 heaters, disengage cabinet latches and open cabinet (fig. 1).
- (d) Remove engine exhaust plug from exhaust extension and dust plug

- from engine hose assembly quick-disconnect coupling.
- (e) Remove three thumb screws (fig. 8) securing the electric motor power unit bracket to the resilient mounts.

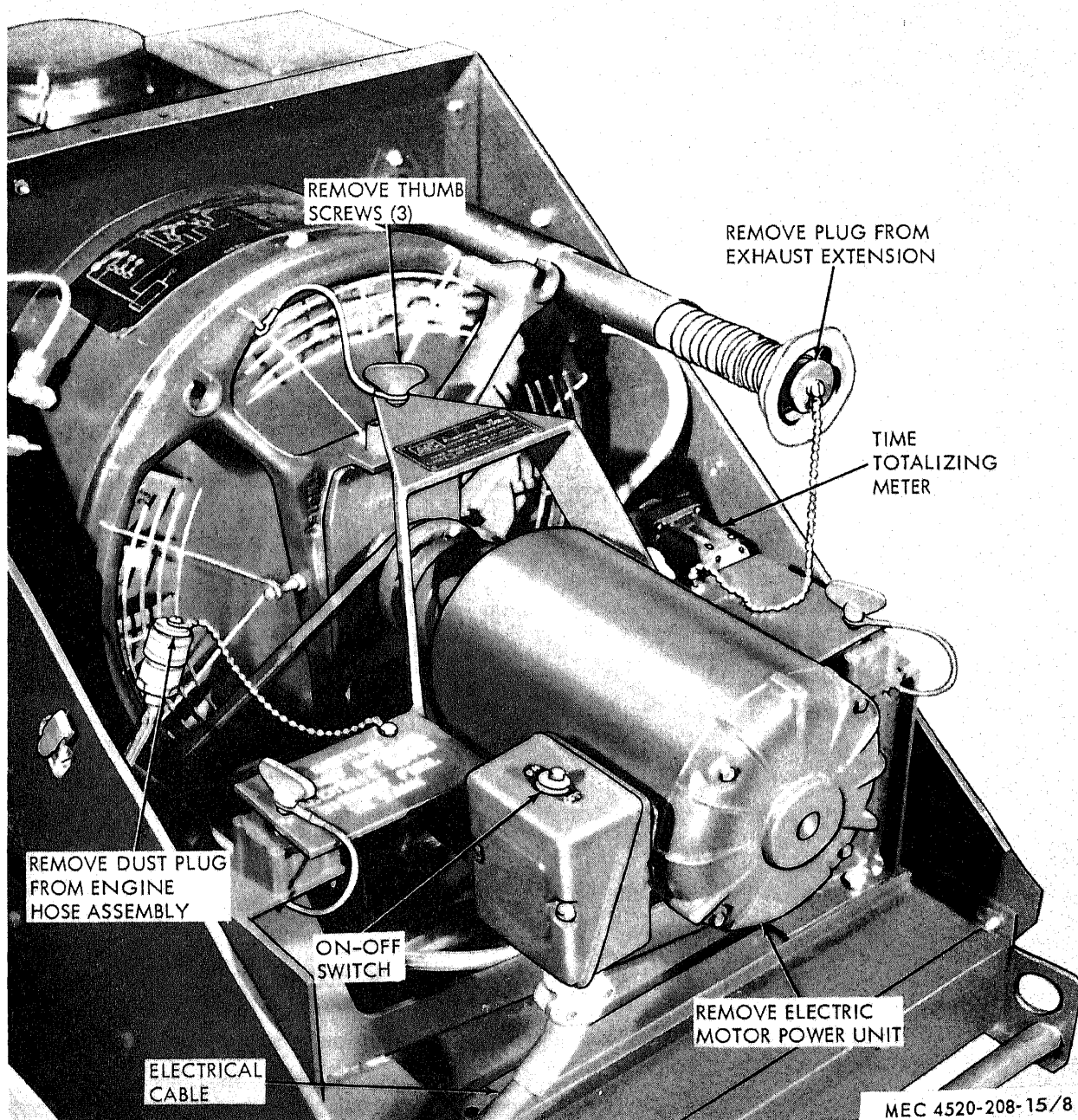


Figure 8. Electric motor power unit, installed view.



- (f) Remove electric motor power unit (fig. 8), with attached bracket, from heater by disengaging drive coupling from flexible rubber sleeve.

**Caution:** Do not damage electric cable when withdrawing cable through cable outlet in side panel.

(2) *Installation.*

- (a) Insert electric cable (fig. 8) through cable outlet in side panel and pull excess cable through outlet.
- (b) Position electric motor power unit, with attached bracket, on heater. Engage drive coupling on electric motor power unit (fig. 8) with flexible rubber sleeve. Align holes in bracket with holes in resilient mounts and secure power unit with three thumb screws. Tighten thumb screws finger tight.
- (c) Install engine exhaust plug in exhaust extension and dust plug in engine hose assembly quick-disconnect coupling.
- (d) On Model BT400-40 heaters, install cabinet to inclose power unit and secure with latches.
- (e) On Model BT400-40-1 heaters, close cabinet to inclose power unit and secure with latches.

### 13. Installation and Setting-up Instructions

a. Position the heater on firm ground with the tow bar (fig. 1) in the lowered position. If the heater tends to roll, chock the wheels to prevent movement. The air hose arrangement depends on nearness to the item to be heated.

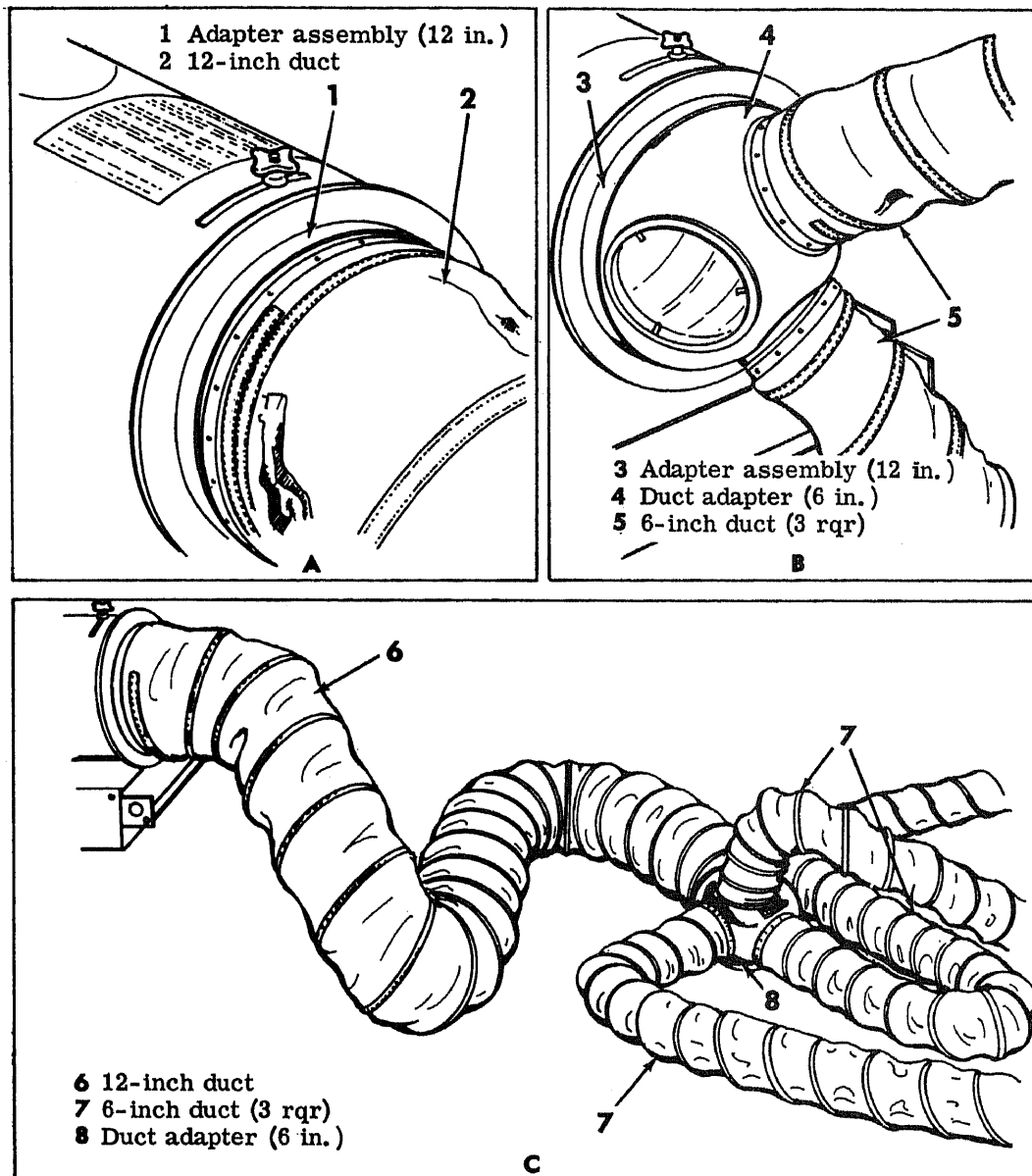
b. Remove discharge outlet cover. If the 12-inch air hose (2, fig. 9) is to be used, attach the 12-inch air hose directly on the 12-inch duct adapter assembly (1).

c. If the 6-inch air hose (5) are to be used, remove the discharge outlet cover and install the 6-inch duct adapter (4) on the 12-inch duct adapter assembly (3). Connect the 6-inch air hose (5) to the 6-inch duct adapter (4).

d. All air hose can be interconnected by installing the 12-inch air hose (6) on the 12-inch duct adapter assembly. Install the 6-inch duct adapter (8) on the 12-inch air hose and attach the 6-inch air hose (7) to the 6-inch duct adapter.

e. If the heater is to be used for heating buildings, or similar inclosures, place the heater near the inclosure and run the air hose through a window or opening. For maximum performance of the heater, all unused space in this opening should be blocked with lumber, canvas, or some similar material.

**Warning:** Do not operate heater in a building. Inhalation of exhaust fumes will result in serious illness or death.



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Figure 9. Heater air hose, installed view.

## Section II. MOVEMENT TO A NEW WORKSITE

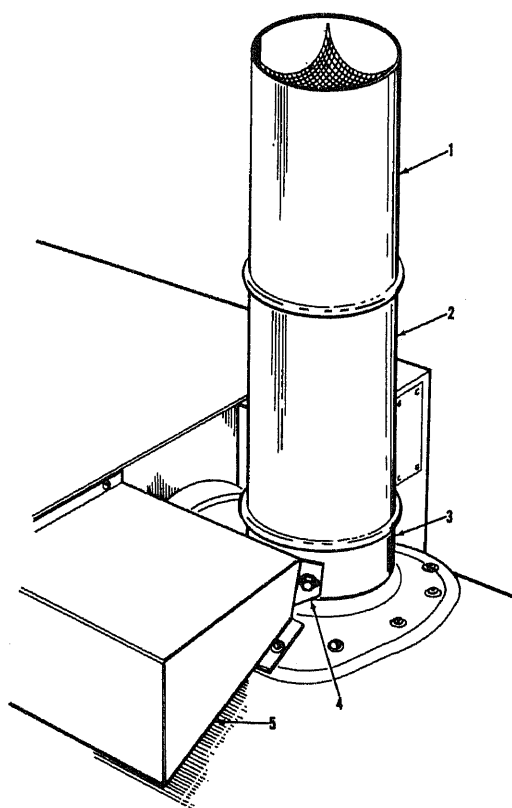
### 14. Dismantling for Movement

a. Remove exhaust pipes (1, and 2, fig. 10) from exhaust stack (3). Install cover on exhaust stack.

b. Remove all air hose (fig. 9), compress

and lock in position. Install discharge outlet cover on duct adapter assembly.

c. Place 12-inch air hose (2, fig. 9), 6-inch duct adapter (4) and the power unit not being used, in the basket (fig. 1).



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Figure 10. Exhaust pipes, installed view.

- 1 Exhaust pipe, with screen
- 2 Exhaust pipe, without screen
- 3 Exhaust stack
- 4 Engine exhaust pipe
- 5 Exhaust shield

Figure 10—Continued.

d. Place a 6-inch air hose on each of the three duct holders (fig. 2).

e. Place exhaust pipes (1 and 2, fig. 10) in cabinet.

f. Install cabinet and close air inlet door.

g. Raise and lock the tow bar (fig. 1) in the towing position, and tow to the new worksite. Several heaters may be towed in tandem by attaching their tow bars to the tow pin (fig. 2) of the preceding heater.

**Caution:** Maximum permissible towing speed is 20 mph over smooth paved surfaces and 10 mph over rough terrain.

### 15. Reinstallation After Movement to a New Worksite

a. Uncouple all heaters if any were towed in tandem.

b. Lower and lock the tow bar (fig. 1) in a vertical position.

c. Install the duct or ducts suitable for the work to be performed (para 13).

## Section III. CONTROLS AND INSTRUMENTS

### 6. General

This section describes, locates, illustrates, and furnishes the operator, crew, or organizational maintenance personnel sufficient information about the various controls and instruments for proper operation of the BT400-40 and BT400-40-1 portable heaters.

### 17. Controls and Instruments

The purpose of the controls and instruments and the normal and maximum readings of the instruments are illustrated in figure 11.

### 18. Discharge Air Temperature Gage

a. The discharge air temperature gage (fig. 11) is located in the control box.

b. The temperature gage is a dial-type instrument which indicates the actual temperature of the discharge air in degrees Fahrenheit.

c. A sensing element (fig. 13) mounted in the discharge air outlet regulates the temperature gage.

### 19. Fuel Control Valve Knob

a. The fuel control valve knob (fig. 11) is mounted in the control box. The fuel control valve turns the combustor off by passing fuel flow to the nozzle. Open the control box cover to gain access to the control.

b. When the knob is depressed, fuel flows to the fuel nozzle. The fuel flow is stopped when the knob is pulled upward. Length of travel of the plunger attached to the knob is approximately 1/8-inch.

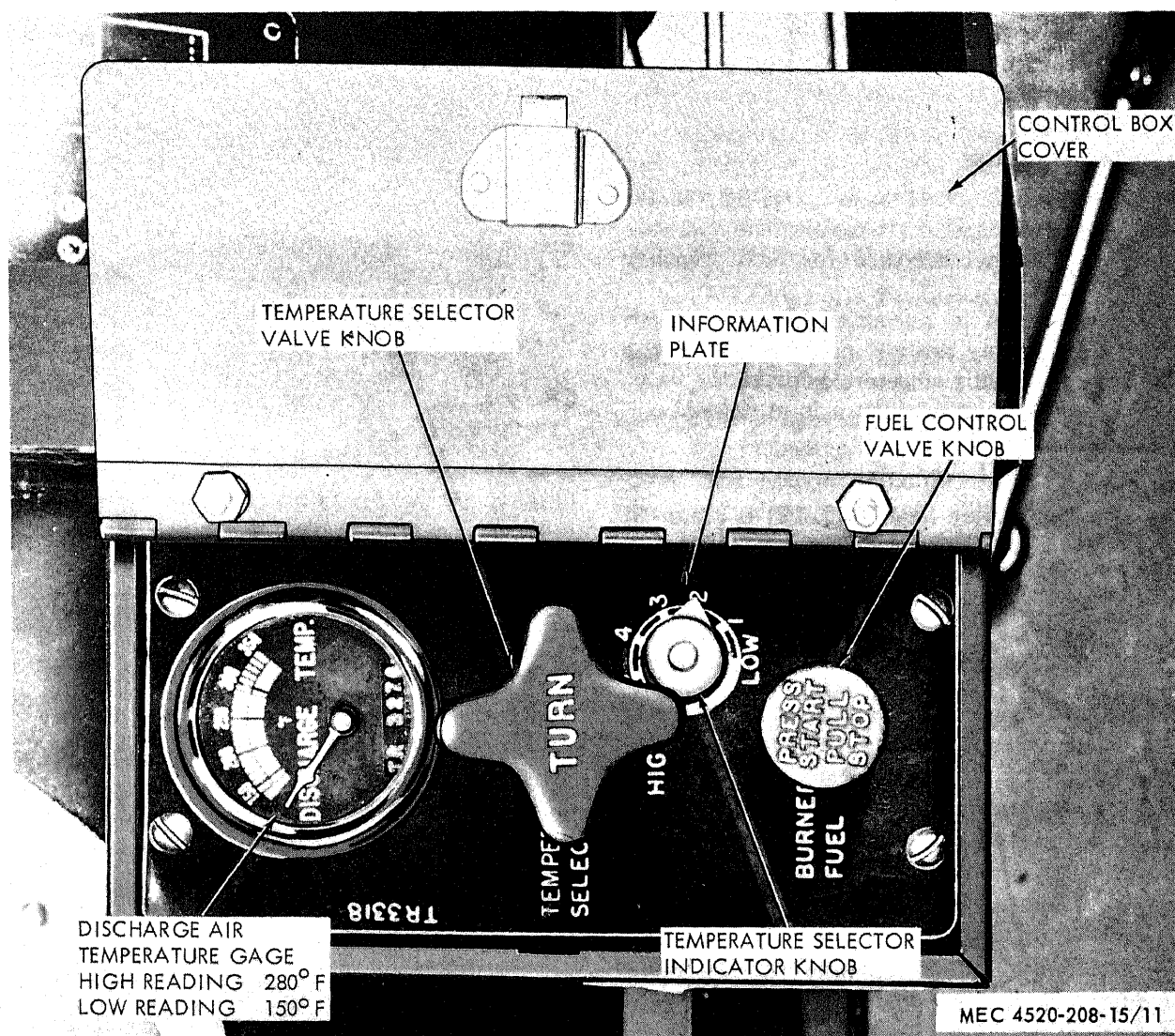


Figure 11. Heater fuel controls.

## 20. Temperature Selector Indicator Knob

a. The temperature selector indicator knob (fig. 11) is mounted on the control panel next to the temperature selector valve knob (fig. 11). Approximate range or temperature selector valve knob is indicated by the pointer on the temperature selector indicator knob. When the temperature selector valve knob is rotated, a pinion on the shaft engages a pinion on the temperature selector indicator knob shaft and rotates the knob in direct relationship to the temperature selector valve knob.

b. The heat range is from a low corresponding to a discharge air temperature of slightly below 150°F to a high corresponding to approximately 280°F. Each number represents 25°, with 150° being close to number "1" on the fuel control panel.

## 21. Temperature Selector Valve Knob

a. The temperature selector valve knob (fig. 11) is mounted in the center of the fuel control panel.

b. Turning the temperature selector valve knob clockwise increases the discharge air temperature; turning it counterclockwise decreases the temperature.

## 22. Choke Control

a. The choke control lever (fig. 12) is located on the carburetor. It enables the operator to enrich the fuel mixture for cold weather starting.

b. The control is an external lever which can be held in any desired position. When the lever is rotated fully counterclockwise the valve is closed and the gas mixture is enriched.

## 23. Stop Switch Lever

a. The stop switch lever (fig. 12) is mounted on the top of the flywheel housing.

b. To stop the engine power unit, set switch lever to OFF position.

## 24. Starting Rope

a. The starting rope is furnished for the purpose of manually cranking the engine power unit.

b. Engage the rope in the flywheel flange and pull rope to start the power unit (fig. 14).

## 25. Fuel and Exhaust Controls

a. The engine hose assembly leading from the fuel tank is a flexible hose equipped with a quick-disconnect coupling (fig. 7). Push coupling away from fuel filter to disconnect hose assembly.

b. An exhaust extension leading from the manifold has a flange near the end. The exhaust extension is inserted into the exhaust pipe and the flange bears on a mating flange on the exhaust pipe under spring pressure to provide a gastight fitting.

## 26. Fuel Gage

a. The fuel gage is mounted beneath the heat exchanger on the right side of the base. The fuel tank cap is next to the gage.

b. The fuel gage is a needle-indicating type, direct reading gage. Graduations on the gage

indicate E (empty), 1/4, 1/2, 3/4, and F (full).

## 27. Time Totalizing Meter (BT400-40)

a. A time totalizing meter (fig. 8) is mounted above the magneto. A rubber belt (preformed packing) drives a pulley attached to the time totalizing meter shaft. The belt is driven by the magneto pulley.

b. The time totalizing meter is direct reading and records the heater operating time in hours.

## 28. Electric Motor Power Unit On-Off Switch

a. An ON-OFF switch (fig. 8) controls operation of the electric motor power unit. The ON-OFF switch is mounted on the electric motor power unit junction box.

b. The ON-OFF switch is a two-position, toggle type switch and is used to start and stop the motor.

## 29. Damper Control

a. The damper control (fig. 13) controls a rotating damper at the discharge end of the

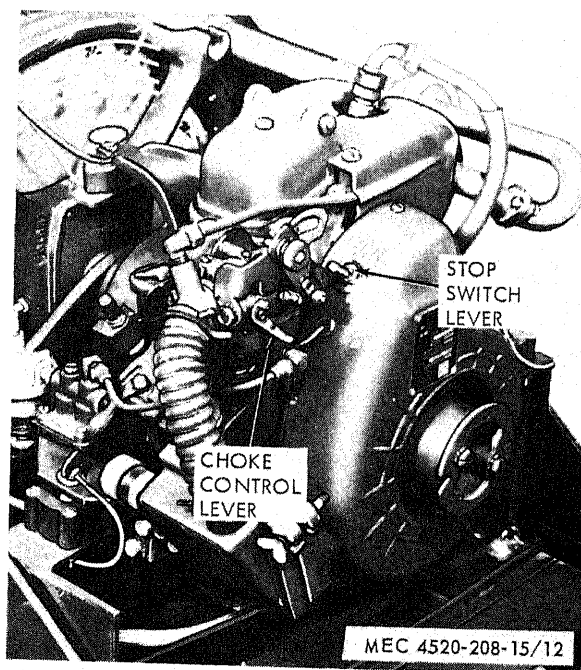


Figure 12. Gasoline engine power unit controls.

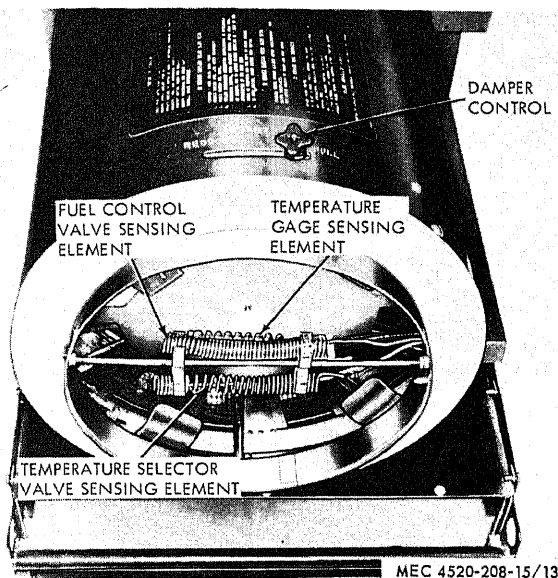


Figure 13. Heater discharge air controls.

heater. The control handwheel is mounted on the top of the casing.

b. The damper control, attached to the damper, is secured by the handwheel. To move the damper control, loosen the handwheel.

c. Moving the damper control as far as possible to the left (when facing discharge end) completely closes the damper. As the damper control is moved to the right the damper opens increasing the volume of discharge air leaving the heater. The damper controls the volume from fuel to one-half the rated flow. The discharge air outlet cannot be completely closed, preventing accidental operation of the heater

with no outlet for the air and possible damage from a heat buildup within the heater.

### 30. Sensing Elements

a. *General.* Three sensing elements are mounted in front of the damper in the discharge end of the heater. The elements are directly in the air stream so the temperature of the air directly affects the elements.

b. *Discharge Air Temperature Gage Sensing Elements (fig. 13).* This element transmits the temperature to the temperature gage mounted in the control box. The temperature gage registers the temperature in degrees Fahrenheit.

c. *Fuel Control Valve Sensing Element (fig. 13).* This element is connected to a diaphragm in the fuel control valve. When the discharge air temperature exceeds safe limits (about 350° F) the gas in the element will expand enough to force the diaphragm up and open the fuel control valve. Opening the fuel control valve opens the primary bypass line (fig. 3) and reduces the outlet pressure at the fuel pump. The drop in pressure makes it impossible for the nozzle to receive fuel, stopping combustion.

d. *Temperature Selector Valve Sensing Element (fig. 13).* Gas in the temperature selector valve sensing element controls a diaphragm in the temperature selector valve. As the discharge air reaches the selected temperature, the gas expands and, through action of the diaphragm, opens the temperature selector valve, decreasing the nozzle fuel flow. The action of the temperature selector valve will maintain the selected temperature by increasing or decreasing fuel flow through the nozzle.

## Section IV. OPERATION OF EQUIPMENT

### 31. General

a. The instructions in this section are published for the information of the personnel responsible for operation of the BT400-40 and BT400-40-1 heaters.

b. The operator must know how to perform every operation of which the heater is capable. This section gives instructions on starting and stopping the heater. Since nearly every job

represents a different problem, the operator may have to vary given procedures to fit the individual job.

### 32. Starting

#### a. Preparation for Starting.

- (1) On Model BT400-40 heaters, remove cabinet (fig. 1) by disengaging latches.

- (2) On Model BT400-40-1 heaters, disengage cabinet latches and open cabinet (fig. 1).
- (3) Perform the necessary daily preventive maintenance services (para 44).
- (4) Remove air outlet and exhaust stack covers.
- (5) Remove fuel tank cap and insure that the cap valve is set to OPEN. Install fuel tank cap.

*b. Starting Gasoline Engine Power Unit.*

- (1) Refer to figure 14 and follow instructions to start the gasoline engine power unit.
- (2) After power unit is started, secure cabinet in closed position using cabinet latches.
- (3) Open air inlet door (fig. 1).

*c. Starting Electric Motor Power Unit.* The heater, operating with electrical power pack, must be grounded prior to operation. The ground can be in order of preference, and underground water piping system, a metal rod driven into the ground, or a metal plate buried in the ground. A ground rod must have a minimum diameter of 3/4-inch if hollow or 5/8-inch if solid, and it must be driven to a depth of at least 8 feet. A ground plate must have a minimum area of 9 square feet and must be buried to a depth of at least 4 feet. The ground lead must be a No. 6 AWG (American Wire Gage) copper wire. Bolt or clamp one end of the ground lead to the ground rod, ground plate, or piping system. Connect the other end of the ground lead to the heater. Start electric motor power unit in the following manner.

- STEP 1. PLACE CHOKE LEVER IN VERTICAL POSITION (COMPLETELY CLOSED). PLACE STOP SWITCH LEVER IN RUN POSITION.
- STEP 2. CONNECT STARTER ROPE TO FLYWHEEL FLANGE. WRAP ROPE AROUND FLANGE AND PULL ROPE HANDLE VIGOROUSLY TO START ENGINE.
- STEP 3. AFTER ENGINE STARTS AND WARMS UP, GRADUALLY MOVE CHOKE CONTROL LEVER TO HORIZONTAL POSITION.

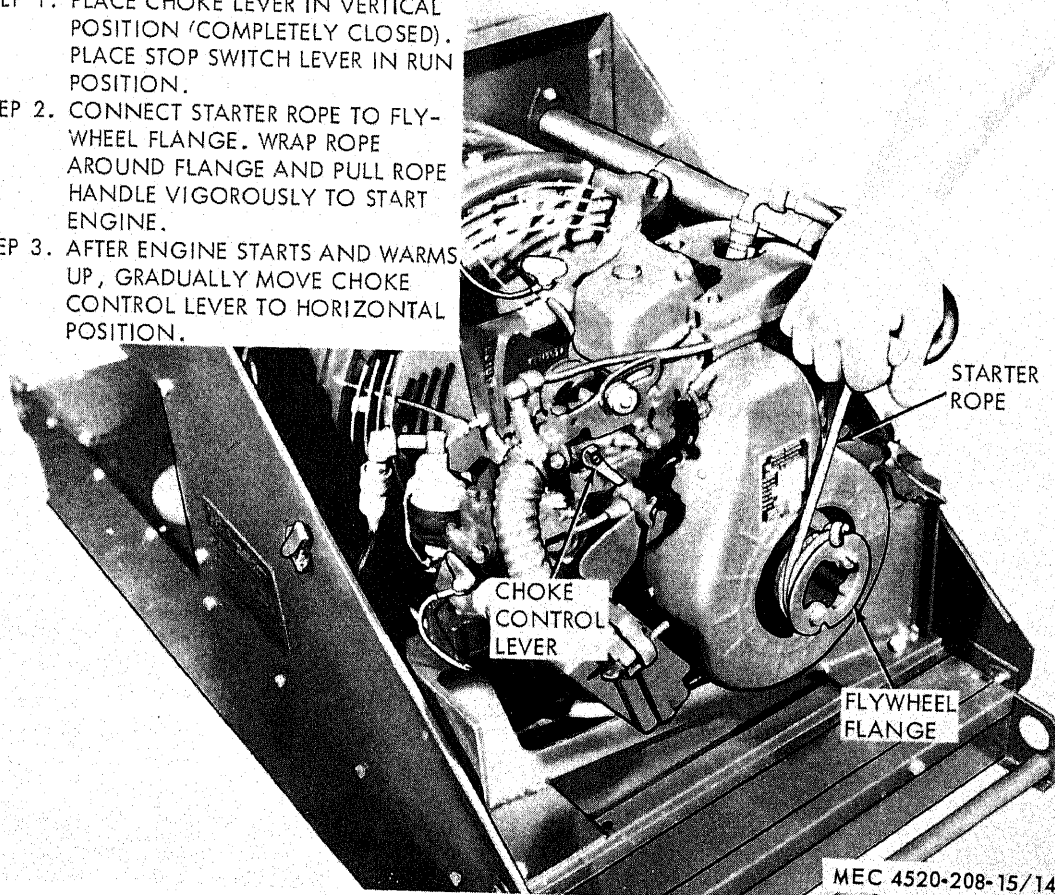


Figure 14. Starting gasoline engine power unit.



- (1) Drive the ground rod (7, fig. 54) into ground to insure a proper ground.
- (2) Connect ground clamp (13) to ground rod.
- (3) Connect electrical clip (14) to one end of electrical wire (9). Connect other end of wire to ground clamp.
- (4) Connect electrical clip to heater and insure a metal to metal contact is made.
- (5) Connect electric motor cable to 208-220 volt, 60 cycle, three-phase power source.
- (6) Place ON-OFF switch lever on electric motor (fig. 8) in ON position.

*Note.* Motor must rotate in counterclockwise direction when facing motor shaft. Interchange two motor leads if direction of rotation is clockwise.

- (7) After power unit is started, secure cabinet in closed position using cabinet latches.
- (8) Open air inlet door (fig. 1).

*d. Starting the Heater Combustor.*

- (1) Depress fuel control valve knob (fig. 11).
- (2) Set temperature selector valve to desired temperature.

### 33. Stopping

*a. Heater Combustor.* Pull fuel control valve knob (fig. 11) to stop heater combustor.

*Note.* Allow the power unit to operate for two minutes after fuel control valve is shut off.

*b. Gasoline Engine Power Unit.*

- (1) Open access door on top of cabinet.
- (2) Stop gasoline engine power unit by setting stop switch lever to the OFF position.
- (3) On Model BT400-40 heaters, remove the cabinet (fig. 1) by disengaging latches.
- (4) On Model BT400-40-1 heaters, disengage cabinet latches and open cabinet (fig. 1).
- (5) Perform the necessary daily preventive maintenance services (para 44).
- (6) Secure cabinet in closed position using cabinet latches.

- (7) Install exhaust stack and air outlet covers.

*c. Electric Motor Power Unit.*

- (1) Open access door on top of cabinet.
- (2) Stop electric motor power unit by moving ON-OFF switch lever (fig. 8) to OFF position.
- (3) On Model BT400-40 heaters, remove the cabinet (fig. 1) by disengaging latches.
- (4) On Model BT400-40-1 heaters, disengage cabinet latches and open cabinet (fig. 1).
- (5) Perform the necessary daily preventive maintenance services (para 44).
- (6) Secure cabinet in closed position using cabinet latches.
- (7) Install exhaust stack and air outlet covers.

### 34. Operation Under Usual Conditions

*a. Start the Heater.* Refer to paragraph 32 and start the heater.

*b. Operate Heater.*

- (1) With the heater operating and the air inlet door open, refer to paragraph 13 and connect the ducts to the heaters as required.
- (2) Set damper control (fig. 13) to full open position, with handwheel all the way to the right (when facing the discharge end).
- (3) Rotate temperature selector valve knob (fig. 11) to desired discharge temperature.
- (4) Regulate damper control (fig. 13) to the desired volume.
- (5) The heater should attain the desired discharge air temperature in two minutes. Due to a lag in operation of the discharge air temperature gage (fig. 11), the correct temperature will not be indicated for a few more minutes.
- (6) If temperature gage does not indicate the desired temperature within 5 minutes, adjust the temperature selector valve knob as necessary, to obtain the required discharge air temperature.



c. *Stopping the Heater.* Refer to paragraph 33 to stop the heater. Remove ducts and store ducts on trailer. Install outlet cover.

### 35. Operation in Extreme Cold (Below 0°F)

#### a. General.

- (1) Fill fuel tank daily to prevent condensation. Remove snow or ice from fuel tank cap and dispensing equipment before filling fuel tank.
- (2) Use the proper lubricants as specified in the current lubrication order.
- (3) Service gasoline engine fuel filter (para 48) daily to remove water.
- (4) Operate heater a short time each day to prevent water from getting in heater controls.
- (5) Cover heater with a tarpaulin to protect from the weather.
- (6) Park heater in a sheltered spot out of the wind, or park on high, dry ground or concrete. If ground is wet or thawing is imminent, park trailer on planks to prevent wheels from freezing in place.
- (7) Clean all parts of heater of snow, ice, and mud as soon as possible after operation.

#### b. Gasoline Engine.

- (1) *Charge oil prior to cold exposure.*
  - (a) Drain the engine fuel system to remove all traces of water.
  - (b) Connect engine to a supply of Arctic gasoline. Start engine (para 32) and operate until engine is warm.
  - (c) Shut down engine and drain the oil. Refill with MIL-L-10295 (OES) engine oil.
  - (d) Start engine and operate for one minute.
- (2) *Exposed to -65°F.*
  - (a) Preheat engine. Light the winterization torch according to instructions on figure 15.
  - (b) Adjust winterization torch to the proper flame and concentrate the heat on the following areas:

1. *Cooling air discharge.* Direct heat at this opening, keeping the tip of the flame at the edge of the opening and horizontal with the base. Move the torch back and forth across this opening. Moving torch will prevent "hot spots" and heat will pass under the oil sump and up the cooling shrouds to the cylinder walls and heads. CONTINUE FOR 3 MINUTES.

2. *Flywheel opening.* Direct heat at this opening, moving the torch as stated in 1. above. This will warm flywheel and transfer heat to crankshaft. CONTINUE FOR 1 MINUTE.

3. Repeat 1 above. Turn the engine over occasionally.

4. Repeat 2 above.

5. *Intake manifold, fuel pump, and fuel filter.* Direct heat at these areas alternately, keeping tip of flame approximately 3 inches from surface. Always keep torch moving. CONTINUE FOR 1 MINUTE.

- (3) *Starting.* After Steps 1 through 5 above have been completed, the engine is ready to be started immediately. The following are simple and proven starting procedures.

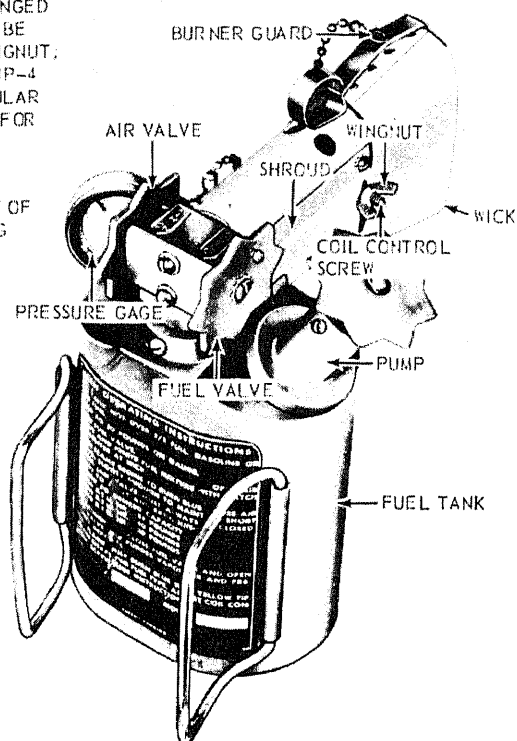
- (a) A firm steady pull is all that is required.

- (b) Make one pull with the choke fully closed (be prepared to partially open choke should the engine fire.) Make the next pull with the choke in the 1/2 open position. If the engine does not start, more heat may be required. After heating, the flywheel should turn easily by hand. DO NOT OVER CHOKE.

- (4) *Exposed to 45°F.* For starts at a 45°F, the same procedures are required, though a shorter heating period is satisfactory. Heating period, however, should not be less than 7 minutes.

NOTE: WHEN TYPE OF FUEL IS CHANGED COIL CONTROL SCREW MUST BE REPOSITIONED. LOOSEN WINGNUT; PLACE SCREW AT TOP FOR JP-4 FUEL, IN CENTER FOR REGULAR GASOLINE, AND AT BOTTOM FOR ARCTIC GASOLINE.

WARNING: DO NOT STAND IN FRONT OF TORCH WHILE IT IS BEING IGNITED.



1. TURN PUMP COUNTERCLOCKWISE AND REMOVE FROM FUEL TANK.
  2. FILL FUEL TANK TWO-THIRDS FULL WITH FUEL.
  3. INSTALL PUMP AND TIGHTEN SECURELY.
  4. CLOSE AIR VALVE AND FUEL VALVE.
  5. OPERATE PUMP UNTIL PRESSURE GAGE READS 50 PSI (POUNDS PER SQUARE INCH).
  6. OPEN FUEL VALVE MOMENTARILY TO SATURATE WICK. CLOSE FUEL VALVE.
  7. REMOVE BURNER GUARD FROM SHROUD.
  8. IGNITE WICK.
  9. OPEN FUEL VALVE; THEN OPEN AIR VALVE.
  10. SLOWLY CLOSE AIR VALVE AS TORCH FLAME BEGINS TO TURN BLUE.
- NOTE: AIR VALVE MUST BE CLOSED EXCEPT WHEN IGNITING AND EXTINGUISHING TORCH.
11. LOOSEN WINGNUT, MOVE CONTROL SCREW UP OR DOWN UNTIL FLAME BURNS BLUE WITH YELLOW TIP, AND TIGHTEN WINGNUT.
- NOTE: FLAME MUST HAVE SOME YELLOW TIP TO KEEP AIR-FUEL MIXTURE AT PROPER TEMPERATURE.
12. HEAT OUTPUT OF TORCH IS DETERMINED BY FUEL TANK PRESSURES LISTED BELOW.  
 REPUMP AS REQUIRED.
    - 55 PSI - 50,000 BTU/HR (BRITISH THERMAL UNITS PER HOUR)
    - 40 PSI - 25,000 BTU/HR
    - 20 PSI - 15,000 BTU/HR
  13. TO EXTINGUISH TORCH; CLOSE FUEL VALVE AND OPEN AIR VALVE.
  14. INSTALL BURNER GUARD ON SHROUD.

MEC 4520-208-15/15

Figure 15. Winterization torch operating instructions.

### 36. Operation in Dusty or Sandy Areas

a. Locate heater in an area free of sand, dust, or loose earth, if possible.

b. Before operating, if water is available, wet surrounding area with water to keep down accumulation of dust.

c. Take all necessary precautions to prevent dust or sand from entering fuel tank while filling.

d. Perform more frequent inspections and lubrication. Wipe off all excess lubricant. Refer to TM 5-2805-208-14 for inspection and lubrication procedures pertaining to the Model 1A08-III Military Standard Engine.

e. Remove accumulations of sand and dirt at frequent intervals.

f. When not in operation close air inlet door (fig. 1) and control box cover (fig. 11) and install exhaust stack and air outlet covers. Cover heater with tarpaulin.

### 37. Operation in Salt Water and High Humidity Areas

a. Wipe all accessible exposed areas frequently.

b. Coat all exposed machined surfaces with oil.

c. Keep fuel tank cap tightly closed.

d. Keep electrical connections dry.

e. Growth of fungus is the major cause of failure in humid climates. Take every precaution to keep the equipment dry, and well ventilated. Replace any part attacked by fungus.

## CHAPTER 3

### OPERATOR AND ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

#### Section I. SPECIAL TOOLS AND EQUIPMENT

##### 38. Special Tools and Equipment

No special tools or equipment are required by the operator or organizational maintenance personnel for the maintenance of the BT400-40 and BT400-40-1 heaters.

##### 39. Basic Issue Tools and Equipment

Tools and repair parts issued with or author-

ized for the BT400-40 and BT400-40-1 heaters are listed in the basic issue items list, Appendix III of this manual.

##### 40. Organizational Maintenance Repair Parts

Organizational maintenance repair parts are listed and illustrated in TM 5-4520-208-25P.

#### Section II. LUBRICATION

##### 41. General Lubrication Information

a. The lubrication chart for the Model 1A08-III Military Standard Engine is contained in TM 5-2805-208-14. For the current lubrication order, refer to DA-PAM-310-4.

b. The lubrication chart shown in figure 16 is the approved lubrication chart for the BT400-40 heater and the BT400-40-1 heater.

##### 42. Detailed Lubrication Information

a. *General.* Keep all lubricants in closed containers and store in a clean, dry place away from external heat. Allow no dust, dirt, or other foreign material to mix with the lubricants. Keep all lubrication equipment clean and ready for use.

b. *Cleaning.* Keep all external parts not requiring lubrication clean of lubricants. Before lubricating the equipment, wipe all lubrication points free of dirt and grease. Clean with an approved cleaning solvent and dry thoroughly. Clean all lubrication points after lubrication to prevent the accumulation of foreign matter.

c. *Points of Lubrication.* The points of lubrication are identified and illustrated on figure 16. The following information supplements that which is given in the lubrication chart.

d. *Gasoline Engine Unit.* Refer to TM 5-2805-208-14 for lubrication information and procedures pertaining to the Model 1A08-III Military Standard Engine.

e. *Electric Motor Power Unit.* The electric motor power unit has sealed bearings and no lubrication is required.

##### f. *Wheel Bearings.*

- (1) Jack up trailer until tire is clear of surface. Block the other wheel to prevent movement.
- (2) Remove grease cap (1, fig. 17) from hub (9).
- (3) Remove cotter pin (10), slotted hex nut (2), and keyed washer (3) from axle assembly (8).
- (4) Pull wheel assembly (5) out to loosen outer bearing cone and rollers (4) from axle and remove bearing cone.
- (5) Remove wheel and hub from axle.

## LUBRICATION CHART

**HEATER, DUCT TYPE, PORTABLE: GASOLINE; 400,000 BTU;  
GASOLINE ENGINE OR ELECTRIC MOTOR DRIVEN BLOWERS  
(AMERICAN AIR FILTER MODELS BT400-40 AND BT400-40-1)  
WITH MILITARY STANDARD ENGINE MODEL 1A08-III AND  
DOER ELECTRIC MOTOR MODEL 66684ZA**

REFERENCE: SM 10-1-C4-1

Intervals are based on normal operations. Reduce to compensate for abnormal and severe conditions. During inactive periods sufficient lubrication must be performed for adequate preservation.

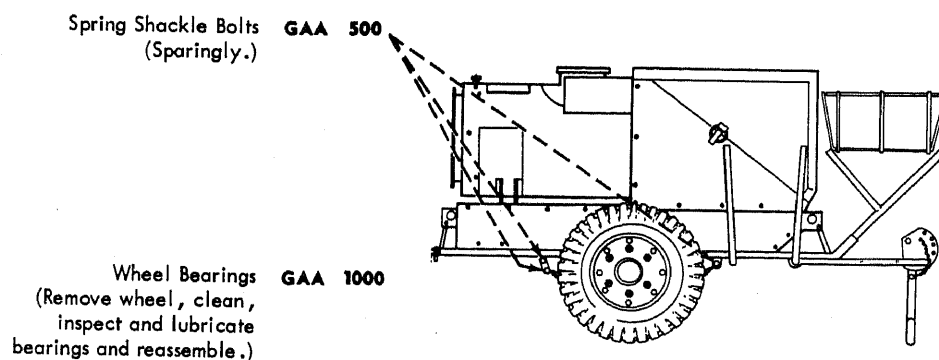
Clean fittings before lubricating.

Relubricate after washing or fording.

Lubricate points indicated by dotted arrow shafts on both sides of the equipment.

Clean parts with SOLVENT, dry-cleaning, or with OIL, fuel, Diesel. Dry before lubricating.

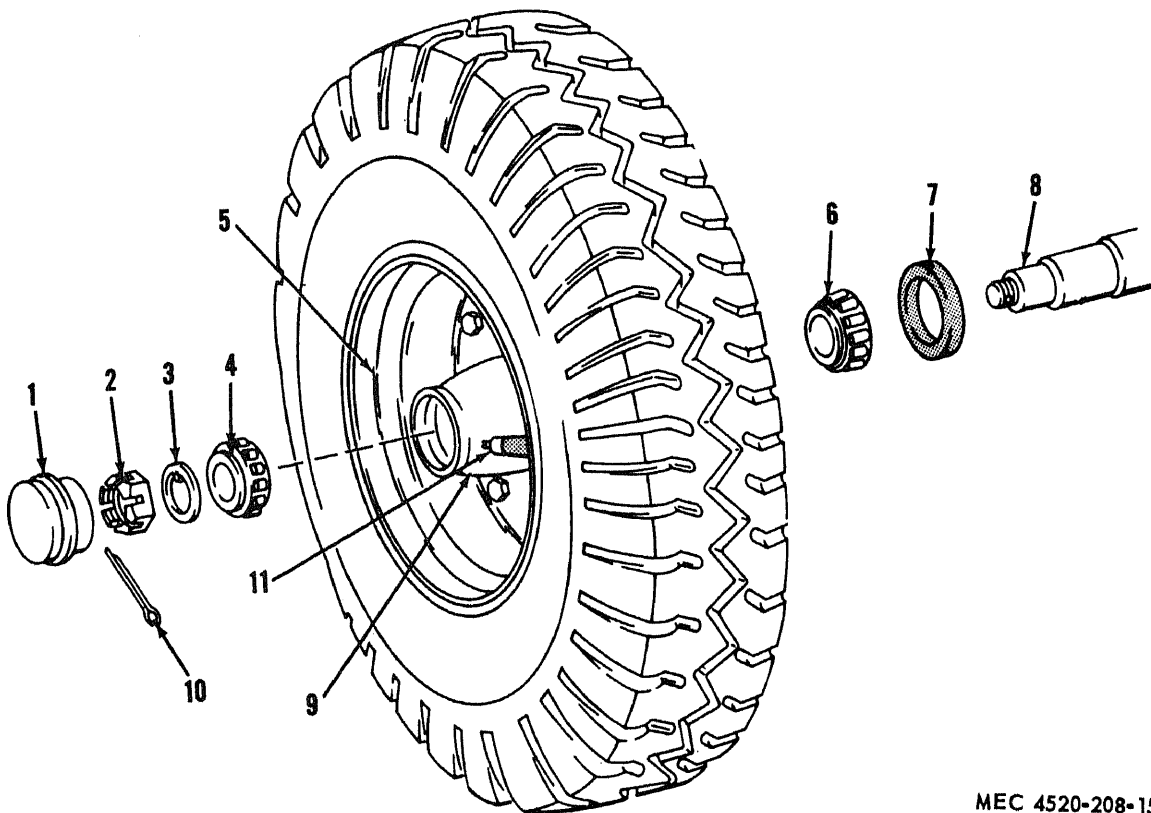
### LUBRICANT • INTERVAL



MEC 4520-208-15/16

Figure 16. Lubrication chart.

- (6) Remove inner bearing cone and rollers (6) and plain encased seal (7) from hub (9).
- (7) Clean all grease from hub and bearing cones with approved cleaning solvent. Dry thoroughly.
- (8) Inspect bearing cones and cups for pitting, chipping, and broken rollers. Replace damaged bearings.
- (9) Pack the bearing cone and rollers (4 and 6) with wheel bearing grease.
- (10) Install plain encased seal (7) and inner bearing cone and rollers (6) in wheel assembly (5).
- (11) Carefully install wheel and hub on axle. Do not damage inner bearing cone or seal when installing wheel.
- (12) Install outer bearing cone and rollers (4) over axle and into the cup inside hub (9).
- (13) Install keyed washer (3) and slotted hex nut (2) on axle assembly (8). Tighten nut until hub (9) binds slightly when rotating the wheel. Back off nut one-fourth of a turn and install cotter pin (10) through nut and axle. Spread ends of cotter pin to secure nut. Install grease cap (1).
- (14) Remove blocking and lower jack to remove from trailer frame.
- (15) Place blocks under trailer and jack up other wheel and repack the bearing in the same manner.



MEC 4520-208-15/17

- |                                      |  |
|--------------------------------------|--|
| 1 Grease cap (2)                     | 7 Seal, plain, encased (2)             |
| 2 Nut, slotted, hex, 1-14 (2)        | 8 Axle assembly (also see 15, fig. 45) |
| 3 Keyed washer (2)                   | 9 Hub assembly (also see 2, fig. 45)   |
| 4 Outer bearing cone and rollers (2) | 10 Pin, cotter, 1/8 x 1-3/4 in. (2)    |
| 5 Wheel assembly (2)                 | 11 Tube valve cap                      |
| 6 Inner bearing cone and rollers (2) |  |

Figure 17. Wheel bearings.

### Section III. PREVENTIVE MAINTENANCE SERVICES

#### 43. General

To insure that the heater is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary Preventive Maintenance Services are listed and described in paragraphs 44 through 47. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit shall be noted for future correction, to be made as soon as the operation has ceased. Stop operation immediately if a deficiency is noticed during operation which would damage the equipment if the operation was continued. All deficiencies and shortcomings will be recorded together with the corrective action taken on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

#### 44. Daily Preventive Maintenance Services

This paragraph contains an illustrated tabulated listing of preventive maintenance services which must be performed by the operator. The item numbers are listed consecutively and indicate the sequence of minimum requirements. Refer to figure 18 for the Daily Preventive Maintenance Services.

#### 45. Quarterly Preventive Maintenance Services

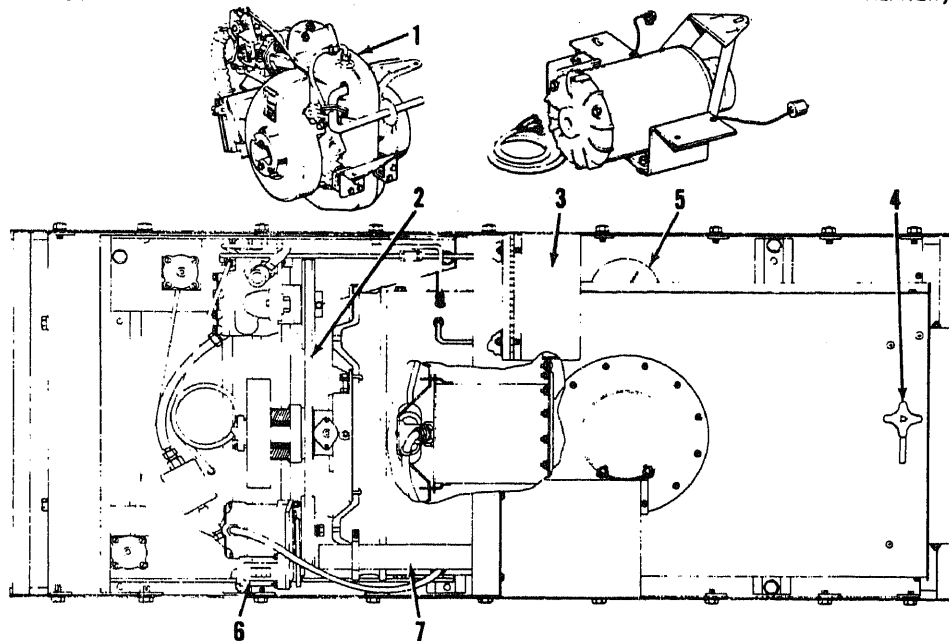
a. This paragraph contains an illustrated tabular listing of preventive maintenance services to be performed by Organizational Maintenance personnel at quarterly intervals. A quarterly interval is equal to 3 calendar months, or 250 hours of operation, whichever occurs first.

b. The item numbers are listed consecutively and indicate the minimum requirements. Refer to figure 19 for Quarterly Preventive Maintenance Services.

## PREVENTIVE MAINTENANCE SERVICES DAILY

TM 5-4520-208-15

HEATER, PORTABLE



LUBRICATE IN ACCORDANCE WITH CURRENT LUBRICATION CHART

ITEM

PAR REF

1	<u>1A08-III MILITARY STANDARD ENGINE.</u> Refer to TM 5-2805-208-14.	
	Inspect for leaking fuel line and connection.	
	Inspect for oil leaks.	
	Inspect for bent, cracked or broken parts.	
	Check oil level. If necessary, add oil to the "FULL" line of the oil gage rod. CAUTION: Do not overfill.	
	Inspect fuel filter for dirt, water and sediment. Clean if necessary.	48
2	<u>V-BELT.</u> Proper adjustment is a deflection of 1/4 of 1/2-inch midway between pulleys.	47
3	<u>CONTROLS AND INSTRUMENTS.</u> Check the controls and instruments for visible damage and broken glass. See that they function properly and are in good condition.	99, 100
4	<u>DAMPER CONTROL.</u> Operate control to check for damage and smoothness of operation.	29
5	<u>FUEL TANK.</u> Check fuel supply and check tank for leaks. Fill fuel tank with proper grade of fuel.	95

MEC 4520-208-15/18 ①

Figure 18 (1). Daily preventive maintenance services.



ITEM		PAR REF
6	TIME TOTALIZING METER DRIVE BELT (BT400-40). Check belt for wear and for tension. Replace belt if worn or stretched.	102
7	EXHAUST PIPE. Check exhaust pipe for secure mounting and dents or other damage. Check end where exhaust extension from engine is inserted for dents or crimps which may cause leaks.	79
NOTE 1. OPERATION. During operation observe any unusual noises or vibrations.		
NOTE 2. AFTER OPERATION. Clean exterior of all dirt and oil.		

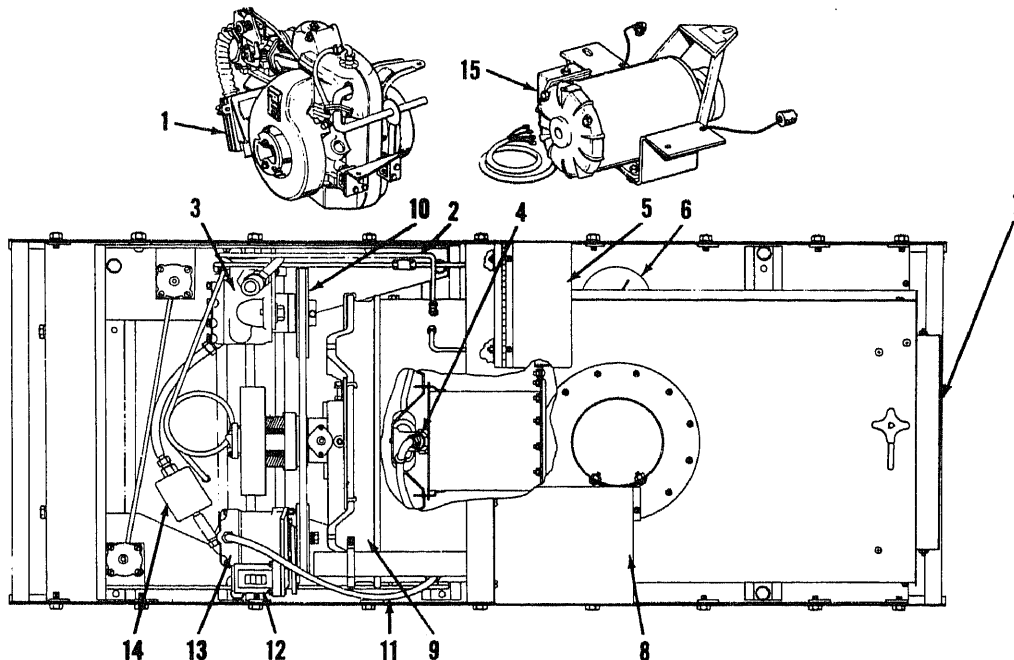
MEC 4520-208-15/18 (2)

Figure 18 (2)—Continued.

## PREVENTIVE MAINTENANCE SERVICES QUARTERLY

TM 5-4520-208-15

HEATER, PORTABLE.



LUBRICATE IN ACCORDANCE WITH CURRENT LUBRICATION CHART

ITEM

PAR REF

1	<b>1A08-III MILITARY STANDARD ENGINE.</b> Refer to TM 5-2805-208-14	
	Inspect Rocker Arms, Covers, Cylinder Head, Push Rods and Valves; service and/or replace if defective.	
	Tighten loose manifold bolts and nuts. Inspect gasket. Replace defective parts.	
	Inspect breather line assembly. Clean. Replace defective parts.	
	Inspect governor linkage for wear and damage and replace if defective.	
	Inspect fuel pump for loose connections, mountings, cracks, etc. Replace a defective pump.	
	Inspect carburetor for unsatisfactory operation, loose mounting. Replace if defective.	
	Inspect spark plugs for excessive burning and cracked ceramic insulation. Inspect cable for defects. Replace defective plugs and cables.	
	Inspect contact points for pitting and burning. Dress points and adjust if required. Replace defective points.	

MEC 4520-208-15/19 (1)

Figure 19 (1). Quarterly preventive maintenance services.

ITEM		PAR REF
2	<b>TUBE ASSEMBLIES.</b> Inspect the tube assemblies for kinks, breaks, and loose connections. Replace all damaged tube assemblies. Tighten all loose connections.	85, 90
3	<b>FUEL PUMP.</b> Inspect the fuel pump for loose connections, secure mounting, cracks, breaks, or leaks. Replace a defective fuel pump.	85, 90
4	<b>NOZZLE AND COMBUSTOR.</b> Inspect the nozzle for cracks or other defects. Wipe the tip clean, using a clean, soft cloth. Replace defective nozzles. Inspect the combustion chamber for sooty deposits, rust, or fire damage. Report any damage to direct support maintenance.	87, 92
5	<b>CONTROLS AND INSTRUMENTS.</b> Check operation of controls. Operate heater and note that all controls function. Check controls for leaks and damage. If control valves are defective, refer to direct support maintenance. Check temperature gage for broken glass and for correct reading. Replace defective temperature gage.	99, 100
6	<b>FUEL TANK, CAP, AND GAGE.</b> Inspect cap for cracks or dents. Check operation of valve in cap. Replace defective cap. Check fuel gage for secure mounting and broken glass and for correct reading. Replace defective fuel gage. Inspect fuel tank for leaks or damage. Repair defective fuel tank.	95
7	<b>CASING, DAMPER, AND AIR BAFFLES.</b> Inspect the casing, air damper, and air baffles for bends or cracks. Check operation of damper. Check for loose or missing hardware. Inspect sensing elements for secure mounting or damage. Repair all damaged parts or refer to direct support maintenance for repair or replacement.	151, 166
8	<b>EXHAUST SYSTEM.</b> Inspect for secure mounting and for dents or cracks. Inspect condition of asbestos gasket. Inspect exhaust stack cover and exhaust extension for damage. Check screen in exhaust extension for damage. Inspect exhaust extension on engine for secure mounting and any damage to the flange. Replace if damaged.	78-80
9	<b>FAN, MOUNTING RING, AND PULLEY.</b> Inspect for secure mounting and cracks or other damage. Check mounting of pulley and fan. Check for damage and for vibration when operating. Inspect pulley and driven coupling for roughness or wear and for secure mounting. Inspect flexible rubber sleeve for cracks, broken teeth, or deterioration. Inspect insert in sleeve for damage. Repair parts or refer to direct support maintenance for replacement of damaged parts.	77
10	<b>V-BELT.</b> Inspect V-belt for wear, fraying, and stretching. Tighten belt if required. Replace V-belt if defective.	76
11	<b>IGNITION CABLE AND IGNITER PLUG.</b> Check cable for kinks or breaks in shielding. Inspect the igniter plug for looseness, bad connections, and dirty or broken insulator. Tighten loose igniter plug and connections. Clean dirty igniter plug. Set igniter plug gap at 0.125 to 0.1875-inch. Replace damaged ignition cable or igniter plug.	83
12	<b>TIME TOTALIZING METER AND BELT (BT400-40).</b> Check time totalizing meter for secure mounting and proper operation. Inspect the gears for breakage and the indicators for bends or breaks. Check pulley for secure mounting. Inspect belt for wear and stretching. Tighten loose parts. Replace damaged parts.	102

MEC 4520-208-15/19 ②

Figure 19 (2)—Continued.

ITEM		PAR REF
13	<u>MAGNETO.</u> Inspect magneto for loose mounting bolts and wiring connections. Remove end cap and check breaker points for burning or pitting. Measure breaker point gap. Correct gap is 0.015 to 0.018-inch at full separation of points.	82
14	<u>FUEL FILTER.</u> Check fuel filter for loose connection. Replace fuel filter every 250 hours of operation (BT400-40). Replace filter element every 250 hours of operation (BT400-40-1).	88 (BT400-40) 93 (BT400-40-1)
15	<u>ELECTRIC MOTOR POWER UNIT AND WIRING.</u> Inspect electric motor power unit for cracks, breaks, or improper operation. Check ON-OFF switch and wiring for oil soaked condition. Inspect wiring for cracked or frayed insulation, broken wires, and loose or corroded connections. Report all deficiencies to direct support maintenance.	104-106
16	<u>FRAME.</u> Inspect the frame for cracks, broken welds, and loose or missing hardware. Tighten all loose hardware and replace missing hardware. Replace frame if damaged.	115
17	<u>TIRES.</u> Inspect all tires for proper air pressure, abnormal or uneven wear, cuts, embedded foreign material and missing valve caps. Correct air pressure is 20 psi on BT400-40 and 20 psi on BT400-40-1. Replace missing valve caps. Replace damaged tires.	108
18	<u>WHEELS.</u> Inspect for loose or missing screws and nuts. Inspect for leaking grease seals. Inspect wheel bearing adjustment. Replace defective grease seals. Adjust wheel bearings if necessary.	108

MEC 4520-208-15/19 (3)

Figure 19 (3)—Continued.

## Section IV. OPERATOR'S MAINTENANCE

### 46. General

a. The instructions in this section are published for the information and guidance of the operator to maintain the BT400-40 and BT400-40-1 heaters.

b. Refer to TM 5-2805-208-14 for operator's maintenance procedure as applicable to the Model 1A08-III Military Standard Engine.

### 47. V-Belt Adjustment

a. *General.* The V-belt is attached to the drive pulley on the driven coupling, the fuel pump drive pulley, and the magneto drive pulley.

b. *Adjustment.* Refer to figure 21 and adjust the V-belt as follows:

- (1) On Model BT400-40 heaters, remove cabinet by disengaging cabinet latches.
- (2) On Model BT400-40-1 heaters, disengage cabinet latches and open cabinet.
- (3) Loosen two screws securing fuel pump mounting bracket.
- (4) Move fuel pump to the left to tighten V-belt or to the right to place slack in the belt. The elongated mounting slots in the bracket allow movement of the fuel pump.
- (5) Check belt tension. Depress V-belt be-

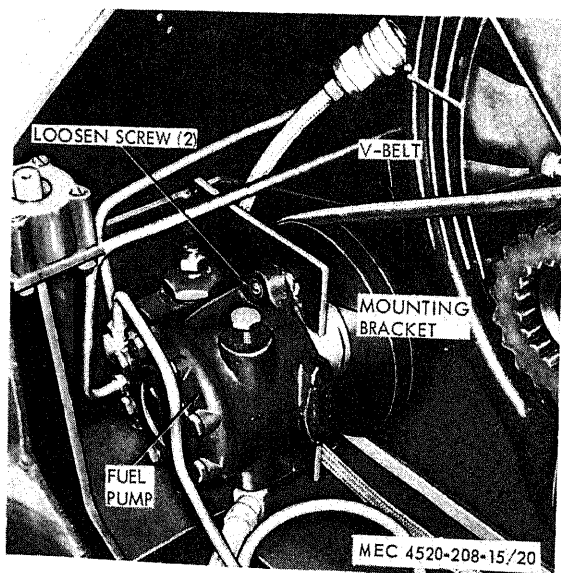


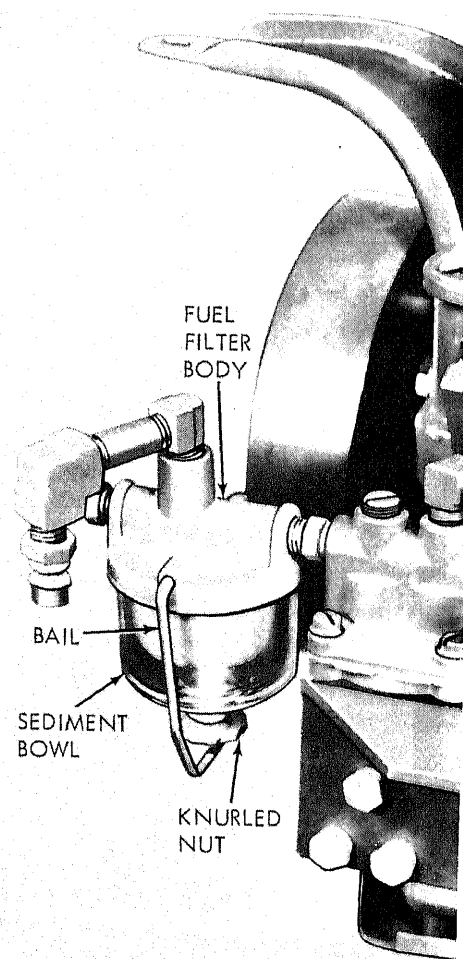
Figure 20. V-belt adjustment.

tween pulleys. V-belt deflection should be from 1/4 to 1/2-inch.

- (6) Tighten fuel pump mounting screws to secure adjustment.
- (7) Secure cabinet in place and engage cabinet latches.

### 48. Gasoline Engine Power Unit Fuel Filter Service

a. *General.* The fuel filter (fig. 21) filters the fuel. Periodic checks must be made to determine if water has settled in the filter sediment bowl.



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Figure 21. Engine power unit fuel filter services.

**b. Removal.**

- (1) On Model BT400-40 heaters, remove by disengaging cabinet latches.
- (2) On Model BT400-40-1 heaters, disengage cabinet latches and open cabinet.
- (3) Loosen knurled nut on the bail and release bail from sediment bowl.
- (4) Remove sediment bowl and gasket from fuel filter body.

**c. Cleaning and Inspection.**

- (1) Clean the filter bowl with an approved solvent and dry thoroughly.
- (2) Examine the bowl gasket for evidence of leakage. Replace a defective gasket.
- (3) Inspect wire filter screen in fuel filter body for sediment or other evidence of

clogging. Refer to TM 5-2805-208-14 for procedures on removal and repair of the fuel filter body.

**d. Installation.**

- (1) Position gasket and sediment bowl in fuel filter body.
- (2) Hinge bail to fuel filter body. Secure the bowl on fuel filter by tightening knurled nut.
- (3) Secure cabinet in place and engage cabinet latches.

**49. Gasoline Engine Power Unit Air Cleaner Servicing**

Refer to TM 5-2805-208-14 for procedures on servicing the gasoline engine air cleaner.

**Section V. TROUBLESHOOTING**

**50. General**

This section provides information useful in diagnosing the correcting unsatisfactory operation or failure of the heater and its components. Each trouble symptom stated is followed by a list of probable causes of the trouble. The possible remedy recommended is described opposite the probable cause. Any trouble beyond the scope of organizational maintenance shall be reported to direct support maintenance.

**51. Gasoline Engine Power Unit Troubles**

Refer to TM 5-2805-208-14 for troubleshooting procedures relating to the Model 1A08-III Military Standard Engine.

**52. Electric Motor Power Unit Fails to Start or is Hard to Start**

Probable cause	Possible remedy
Connection loose or incomplete at power source.	Tighten connection at power source.
Electric cable broken.....	Replace cable (para 106).
Motor fan binding.....	Straighten bent cover or replace damaged fan.

**53. Electric Motor Power Unit Lacks Power**

Probable cause	Possible remedy
Vaneaxial fan rubbing on fan mounting ring.	Tighten mounting cap screws to aline fan or replace damaged part (para 77).
Motor bearings defective....	Replace motor, (para 12).

**54. Electric Motor Power Unit Stops Suddenly**

Probable cause	Possible remedy
Electric cable broken.....	Replace cable (para 106).
ON-OFF switch defective....	Replace ON-OFF switch (para 105).

**55. Electric Motor Power Unit Runs Hot**

Probable cause	Possible remedy
Vaneaxial fan rubbing on fan mounting ring.	Tighten fan mounting cap screws to aline fan or replace damaged part (para 77).
Line voltage low from power source.	Connect to proper power source.
Insufficient ventilation.....	Check screen in air inlet door. Screen may be clogged, restricting air flow. Clean screen.

**56. Electric Motor Power Unit Noisy**

Probable cause	Possible remedy
Motor bearings worn.....	Replace motor (para 12).

## 57. Electric Motor Power Unit Fails to Stop

Probable cause	Possible remedy
ON-OFF switch defective	Replace ON-OFF switch (para 105).

## 58. Heater Ignition Fails

*Note.* To determine whether the above trouble is caused by a faulty ignition system of fuel system, follow the method below to expedite locating the fault: Remove the fan mounting ring and remove the nozzle clamp and combustor plate (para 77). If raw fuel is present in the combustion chamber, inspect trouble symptoms pertaining to ignition system. If no raw fuel is present in the combustion chamber, inspect the trouble symptoms pertaining to the fuel system.

Probable cause	Possible remedy
V-belt slipping or broken	Adjust V-belt (para 47) or replace V-belt.
Igniter plug defective	Adjust or replace igniter plug (para 83).
Magneto points improperly set or defective.	Adjust magneto points (para 82).
Magneto points burned or pitted.	Replace burned or pitted points (para 82).
Heater fuel filter clogged	Replace fuel filter (BT400-40). Service fuel filter (BT400-40-1).
Ignition cable defective	Inspect ignition cable for damage. Replace damaged ignition cable (para 83).
Magneto pulley slipping	Check fit of pulley or replace pulley (para 82).
Fuel supply low (electric motor power unit installed).	Fill fuel tank (para 10).
Tube assemblies clogged or frozen.	Clean, thaw, or replace tube assemblies (para 84, BT400-40 or para 90, BT400-40-1).
Fuel control valve connection loose.	Tighten all connections.
Fuel pump pulley slipping.	Tighten setscrew or replace pulley (para 82).
Fuel nozzle dirty or defective.	Clean the fuel nozzle or replace the nozzle (para 87, BT400-40 or para 92, BT400-40-1).
Fuel pump defective	Replace fuel pump (para 85, BT400-40 or para 90, BT400-40-1).

## 59. Heater Exhaust Smoking Excessively

Probable cause	Possible remedy
Air inlet door closed	Open air inlet door.
Air inlet screen clogged.	Clean air inlet screen.
Nozzle spray pattern incorrect.	Remove mounting ring, nozzle clamp, and combustor plate (para 77). Clean nozzle.

Probable cause
Power unit operating below normal speed.

Possible remedy
Tighten belt or adjust engine rpm.

## 60. Combustor Fire Cuts Out on Overheat

Probable cause	Possible remedy
Air inlet door closed or obstructed.	Open air inlet door or remove obstruction.
Restriction in discharge air stream.	Straighten bent ducts. Replace a collapsed duct.
Temperature selector valve heat sensing element capillary tube ruptured.	Replace valve (para 100).
Fuel control valve sensing element improperly positioned in air stream.	Inspect for proper positioning (para 100).

## 61. Combustor Fire Fails to Cut Out on Overheat

Probable cause	Possible remedy
Fuel control valve temperature sensing element capillary tube ruptured.	Replace fuel control valve (para 100).

## 62. Discharge Air Temperature not in Correct Range

Probable cause	Possible remedy
Temperature selector valve improperly set.	Set valve to correct temperature.
Temperature gage defective.	Check temperature with an accurate thermometer. Replace defective temperature gage (para 99).

## 63. Discharge Air Temperature Fluctuates

Probable cause	Possible remedy
Temperature selector valve defective.	Replace temperature selector valve (para 100).
Defective temperature gage.	Replace defective temperature gage (para 99).

## 64. Maximum Heat Output Not Obtainable

Probable cause	Possible remedy
Fuel system leaks	Tighten all fuel connections. Replace damaged tube assemblies (para 85, BT400-40 or para 90, BT400-40-1).
Temperature selector valve defective.	Replace temperature selector valve (para 100).
Fuel pump defective	Replace fuel pump (para 85, BT400-40 or para 90, BT400-40-1).

## Section VI. RADIO INTERFERENCE SUPPRESSION

### 65. Definitions

*a. Interference.* The term "interference", as used herein, applies to electrical disturbances in the radio frequency range which are generated by the heater and which may interfere with the proper operation of radio receivers or other electronic equipment.

*b. Interference Suppression.* The term "interference suppression," as used herein, applies to the methods used to eliminate or effectively reduce radio interference generated by the heater.

### 66. General Methods Used To Attain Proper Suppression

Essentially, suppression is attained by providing a low resistance path to ground for the stray currents. The methods used include shielding the ignition and high-frequency wires, grounding the frame with bonding straps and using capacitors and resistors.

### 67. Interference Suppression Components

*a. General.* The interference suppression components incorporated in the heater are shown on figure 22.

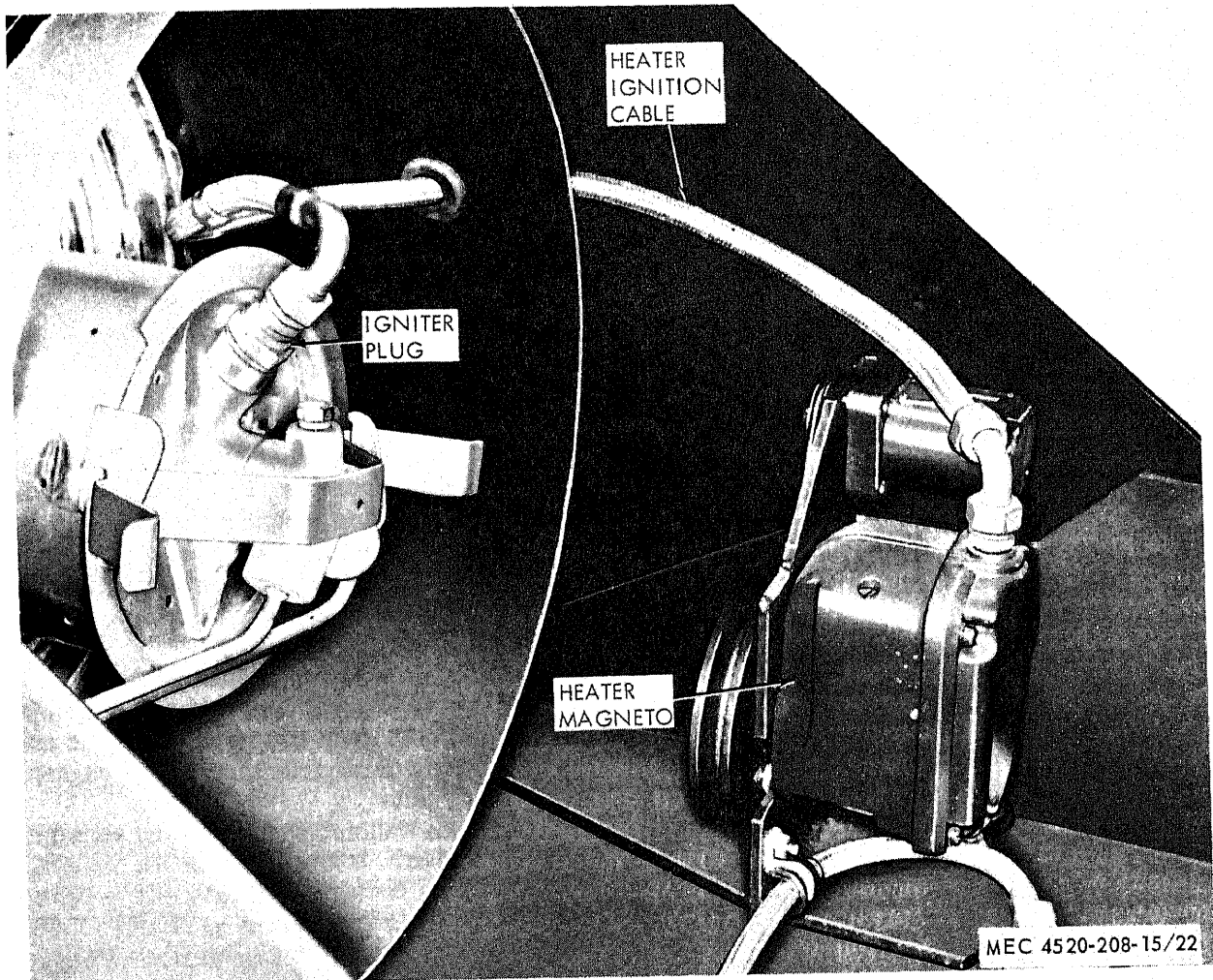


Figure 22. Radio interference suppression components.



*b. Spark Plug.* The gasoline engine spark plug is integrally shielded and suppressed and is located in the cylinder head.

*c. Spark Plug Cable.* The gasoline engine plug cable, leading from the magneto to the spark plug, is encased in a braided metal shield and grounded to the flywheel housing.

*d. Heater Magneto.* The heater magneto is inclosed in a metal frame and end cap.

*e. Ignition Cable.* The heater ignition cable, leading from the heater magneto to the igniter plug, is encased in a braided metal shield.

*f. Igniter Plug.* The igniter plug is integrally shielded and suppressed.

*g. Electric Motor Power Unit.* The electric motor power unit is inclosed in a metal case.

## 68. Replacement of Suppression Comments

*a. Spark Plug.* Refer to TM 5-2805-208-14 for replacement of the spark plug.

*b. Spark Plug Cable.* Refer to TM 5-2805-208-14 for replacement of the spark plug cable.

*c. Heater Magneto.* Refer to paragraph 82 for replacement of the heater magneto.

*d. Ignition Cable.* Refer to paragraph 83 for replacement of ignition cable.

*e. Igniter Plug.* Refer to paragraph 83 for replacement of igniter plug.

*f. Electric Motor Power Unit.* Refer to paragraph 12 for replacement of the electric motor power unit.

## Section VII. CABINET ASSEMBLY

### 69. General

The cabinet assembly (fig. 23) is a welded sheet metal inclosure which fits over the drive section of the heater to protect the power unit and components.

### 70. Repair

*a. Cleaning.* Clean cabinet (fig. 23) using approved cleaning solvent and dry thoroughly. Clean air screen to remove any foreign material.

#### *b. Inspection.*

- (1) Inspect cabinet and air inlet door for bends, dents, cracks, loose welds, corrosion, rust, distortion, or other damage.
- (2) Inspect hinge and catch for proper operation. Check air inlet screen for damage.

*c. Removal (BT400-40).* The cabinet is secured to the heater frame with latches. To remove the cabinet from the heater, disengage the latches and lift cabinet from heater.

#### *d. Removal (BT400-40-1).*

- (1) Disengage latches and open cabinet.
- (2) Remove four screws, lockwashers, and nuts securing door supports to cabinet.
- (3) Remove seven screws, lockwashers, and nuts securing cabinet hinge to heater frame.
- (4) Lift cabinet from heater.

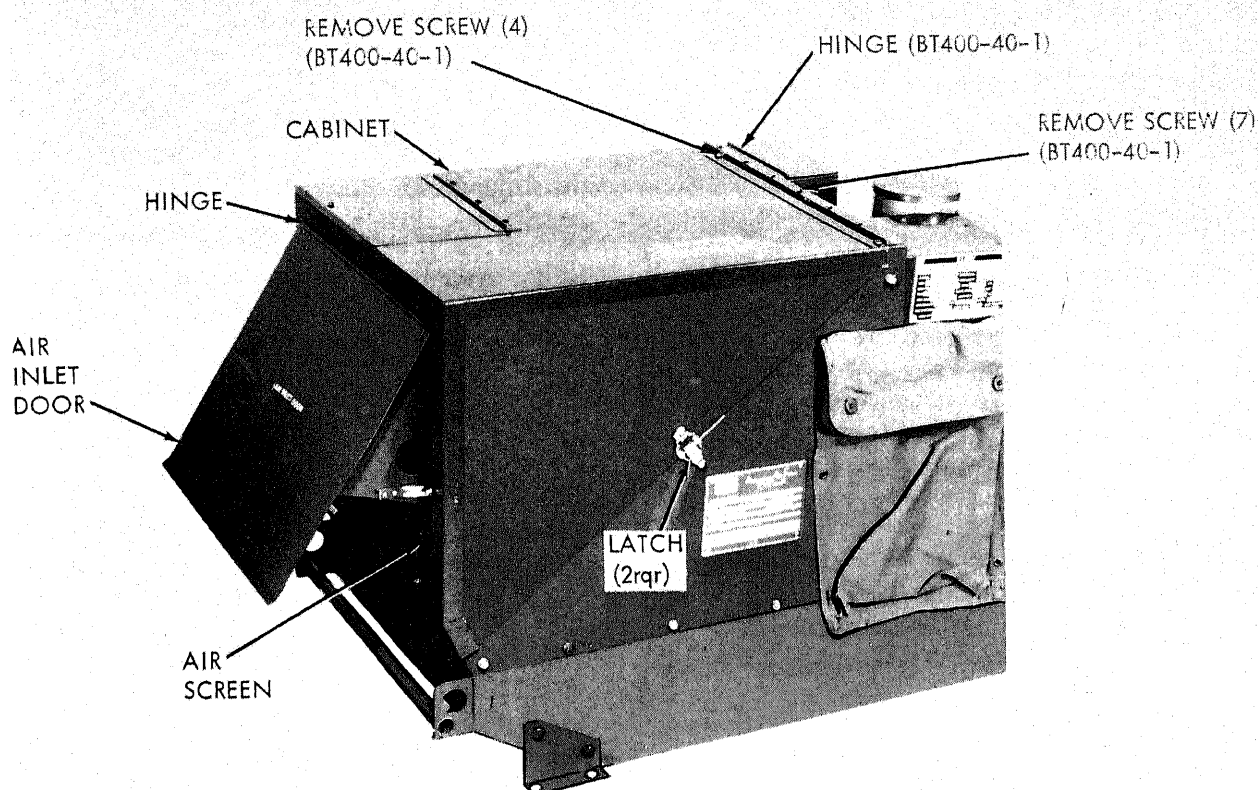
#### *e. Repair.*

- (1) Weld cracks, breaks, and loose welds. Straighten bends and dents.
- (2) Paint all exposed metal surfaces to prevent rusting. Refer to TM 9-213 for painting instructions.
- (3) Replace all damaged parts.

*f. Installation (BT400-40).* Place cabinet on heater and secure by engaging latches.

#### *g. Installation (BT400-40-1).*

- (1) Install cabinet on heater frame and secure screws, lockwashers, and nuts.
- (2) Connect door supports to cabinet and secure using four screws, lockwashers, and nuts.
- (3) Close cabinet and secure by engaging latches.



NOTE  
MODEL BT400-40-1 HEATER  
SHOWN. REFER TO PAR.  
5 FOR DIFFERENCE IN  
MODELS.

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Figure 23. Cabinet assembly

## Section VIII. GASOLINE ENGINE POWER UNIT

### 71. General

a. The gasoline engine power unit is Model 1A08-III Military Standard Engine. Complete repair of the engine is covered in TM 5-2805-208-14. Refer to this technical manual for any repair or adjustment of the gasoline engine.

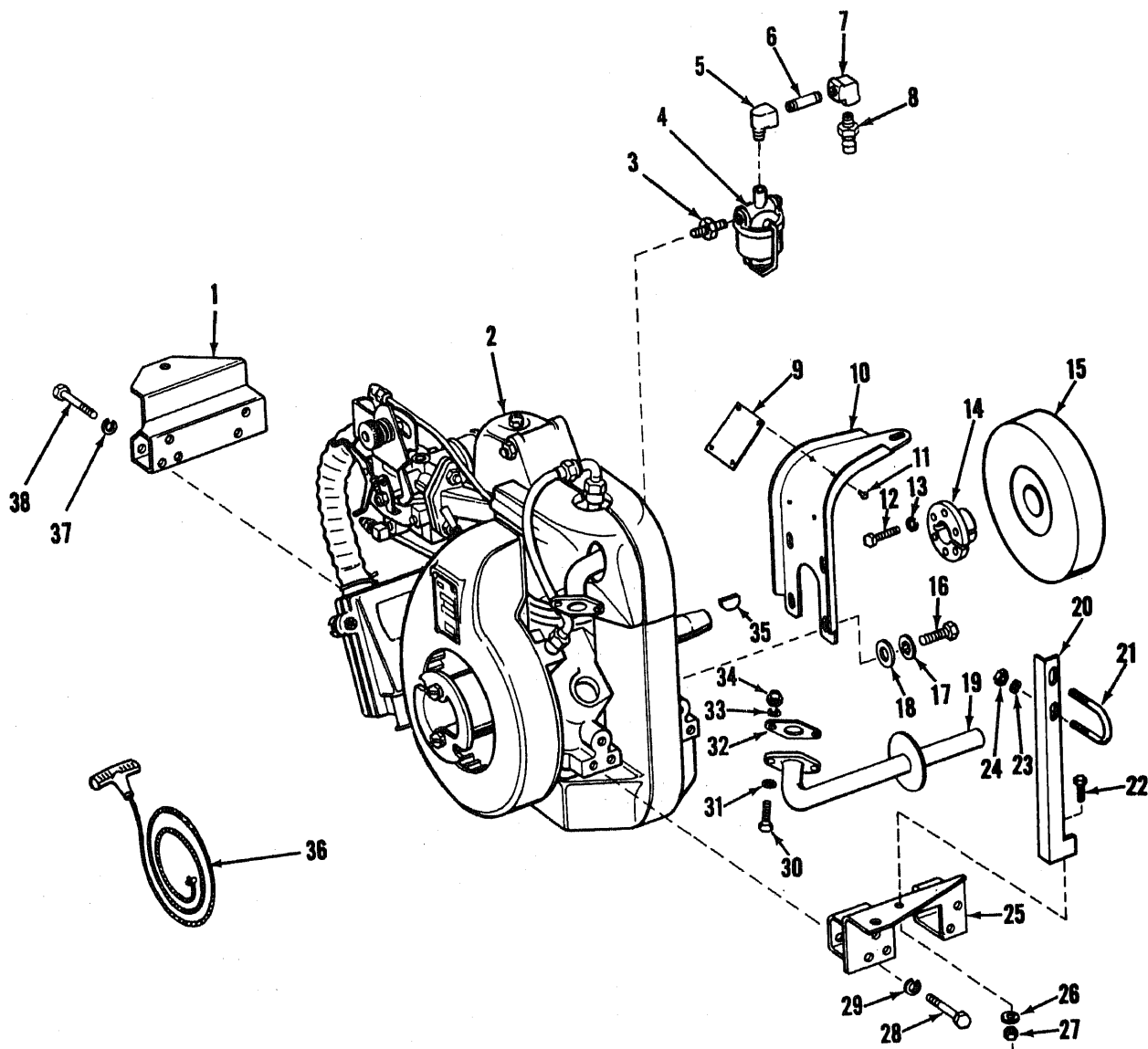
b. Refer to paragraph 12 for removal of the gasoline engine power unit from the heater.

### 72. Engine Power Unit Drive Coupling

a. *General.* Mounted on the crankshaft is a drive coupling (15, fig. 24). The coupling mates with a flexible rubber sleeve and drives the fan and V-belt through a driven coupling and pulley.

b. *Removal.*

(1) Remove drive coupling (15) from crankshaft, using a suitable puller.



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- 1 Left side engine mounting bracket
- 2 Gasoline engine, Model 1A08-III
- 3 Pipe nipple
- 4 Gasoline engine fuel filter
- 5 Pipe elbow
- 6 Pipe nipple
- 7 Elbow, pipe to tube
- 8 Quick disconnect coupling half
- 9 Identification plate, power unit
- 10 Front engine mounting bracket
- 11 Blind rivet (4)

- 12 Screw, cap, hex hd, No. 10-24 x 1 in. (3)
- 13 Washer, lock, No. 10 (3)
- 14 Tapered bushing
- 15 Drive coupling
- 16 Bolt, machine, 5/16-24 x 5/8 in. (4)
- 17 Washer, lock, IT, 5/16 in. (4)
- 18 Washer, flat, 5/16 in (4)
- 19 Exhaust pipe
- 20 Angle bracket
- 21 Bolt, U
- 22 Screw, Cap, hex hd, 1/4-20 x 5/8 in.

Figure 24. Gasoline engine power unit, exploded view.

- 23 Washer, flat, 1/4 in. (2)
- 24 Nut, self-locking, hex, 1/4-28 (2)
- 25 Right side engine mounting bracket
- 26 Washer, lock, IT, 1/4 in.
- 27 Nut, plain, hex, 1/4-20
- 28 Screw, cap, hex hd, 1/4-20 x 2-1/2 in. (5)
- 29 Washer, lock, 1/4 in. (5)
- 30 Screw, machine, No. 10-24 x 7/8 in. (2)

- 31 Washer, flat, No. 10 (2)
- 32 Gasket
- 33 Washer, lock, No. 10 (2)
- 34 Nut, plain, hex, No. 10-24 (2)
- 35 Key, woodruff
- 36 Rope starter assembly
- 37 Washer, lock 1/4 in. (5)
- 38 Screw, cap, hex hd, 1/4-20 2 1/2 (6)

Figure 24—Continued.

- (2) Remove three screws (12) and lockwashers (13) and remove tapered bushing (14) from drive coupling (15).

*c. Cleaning, Inspection, and Repair.*

- (1) Clean all parts in approved solvent and dry thoroughly.
- (2) Check drive coupling for cracks and damaged teeth.
- (3) Inspect tapered bushing for cracks and distortion.
- (4) Replace all damaged parts.

*d. Installation.*

- (1) Install tapered bushing (14) on drive coupling (15).
- (2) Secure tapered bushing to drive coupling with three screws (12) and lockwashers (13) after position drive coupling on drive shaft.

### 73. Brackets

*a. General.* Three mounting brackets attached to the power unit are used to support the power unit in position on the heater. The mounting brackets are secured to resilient mounts with thumb screws.

*b. Removal.*

- (1) Refer to paragraph 72 and remove drive coupling (15, fig. 24) from crankshaft.
- (2) Remove four bolts (16), lockwashers (17), and flat washers (18) and remove front engine mounting bracket (10) from gasoline engine (2).
- (3) Remove five screws (38) and lockwashers (37) and remove left side engine mounting bracket (1) from power unit.
- (4) Remove two self-locking nuts (24) and flat washers (23) and remove U-bolt

- (21). Remove screw (22), lockwasher (26), and nut (27) and remove angle bracket (20).

- (5) Remove five screws (28) and lockwashers (29) and remove right side engine mounting bracket (25) from power unit.

*c. Cleaning, Inspection, and Repair.*

- (1) Clean brackets with approved solvent and dry thoroughly.
- (2) Inspect brackets for cracks, bend, distorted screw holes, rust, and other damage.
- (3) Weld cracks and straighten bent brackets. Paint exposed metal surfaces. Refer to TM 9-213 for painting instructions.
- (4) Replace all damaged parts.

*d. Installation.*

- (1) Install right side engine mounting bracket (25) on power unit and secure with five screws (28) and lockwashers (29).
- (2) Install left side engine mounting bracket (1) on power unit and secure with five screws (38) and lockwashers (37).
- (3) Install front engine mounting bracket (10) on power unit around crankshaft and secure with four bolts (16), lockwashers (17), and flat washers (18).
- (4) Install angle bracket (20) on right side engine mounting bracket (25) and secure with screw (22), lockwasher (26), and nut (27). Install U-bolt (21) through holes in support and around exhaust pipe (19). Secure U-bolt with two flat washers (23) and self-locking nuts (24).
- (5) Refer to paragraph 72 and install drive coupling (15) on engine.

## 74. Fittings

*a. General.* The gasoline engine fuel filter is mounted on the engine power unit when it is received. In addition, two pipe elbows (5 and 7, fig. 24), two pipe nipples (3 and 6) and a quick-disconnect coupling half (8) are installed.

### *b. Removal.*

- (1) Remove quick-disconnect coupling half (8), pipe to tube elbow (7), pipe nipple (6) and pipe elbow (5) from gasoline engine fuel filter (4).
- (2) Remove engine fuel filter from pipe nipple (3).
- (3) Remove pipe nipple (3) from gasoline engine (2).

### *c. Cleaning, Inspection, and Repair.*

- (1) Clean parts in approved solvent and dry thoroughly.
- (2) Inspect fittings for cracks, burs, damaged threads, and other damage.
- (3) Replace damaged parts.

### *d. Installation.*

- (1) Install pipe nipple (3) in gasoline engine (2).
- (2) Install gasoline engine fuel filter (4) on pipe nipple (3).
- (3) Install pipe below (5), pipe nipple (6), pipe to tube elbow (7), and quick-disconnect coupling half (8) into engine fuel filter.

## Section IX. HEAT GENERATOR AIR SYSTEM

## 75. General

*a.* Part of the air forced into the heater by the fan passes into the combustor where it is mixed with atomized fuel from the nozzle forming a combustible fuel-air mixture. This mixture is ignited and burns to heat the exchanger.

*b.* The major portion of the air entering the casing travels through longitudinal passages within and around the heat exchanger. As the air passes through, it is heated. A damper arrangement at the discharge end of the heat exchanger permits regulation of the heated air volume.

## 76. V-Belt

*a. General.* The V-belt, driven by the driven coupling, turns the fuel pump pulley, and magneto pulley.

### *b. Removal.*

- (1) Refer to paragraph 12 and remove the power unit.
- (2) Remove drive V-belt (29, fig. 25) by slipping V-belt from pulleys.

*c. Cleaning, Inspection, and Repair.* Clean V-belt with a clean, damp cloth. Check V-belt for wear, fraying, and stretching. Replace a worn, frayed or stretched V-belt.

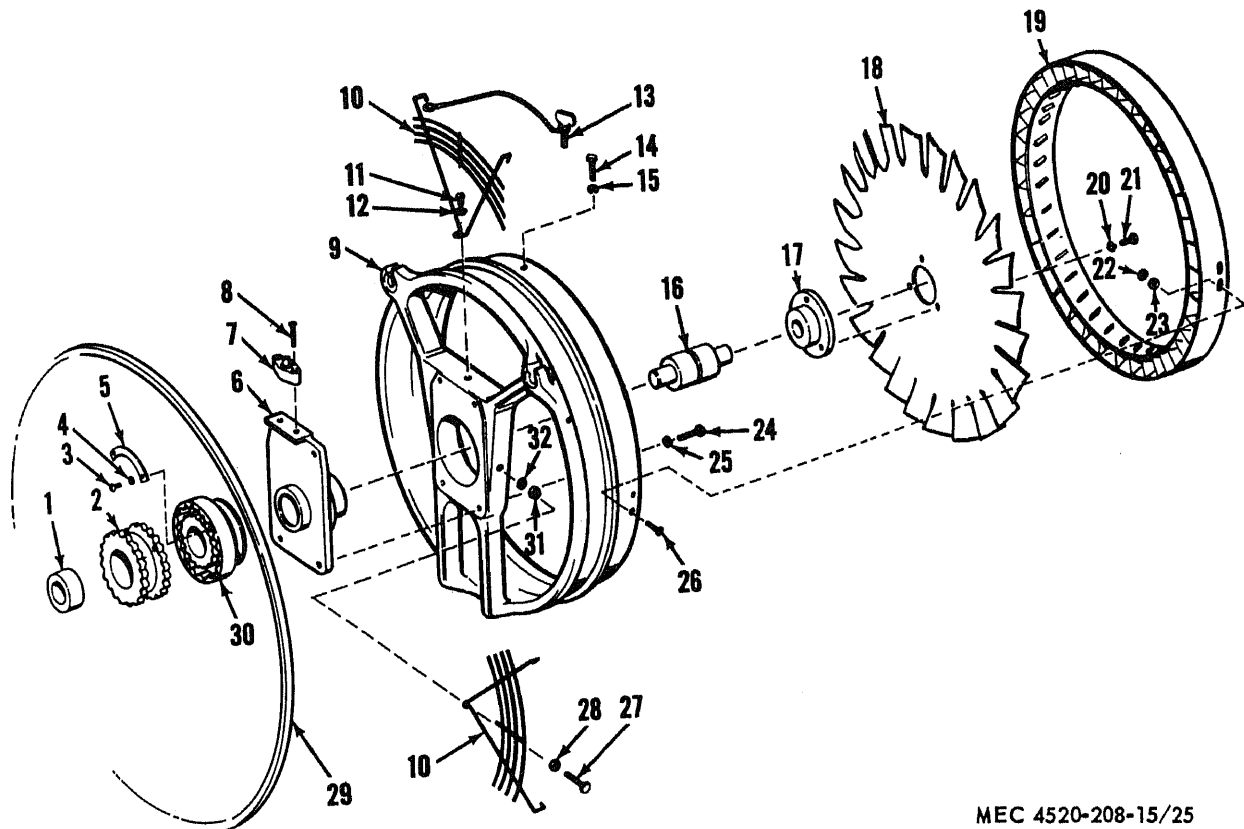
*d. Installation.* Install V-belt over three pulleys. Check V-belt tension and adjust, if necessary (para 47). Refer to paragraph 12 and install power unit.

## 77. Vaneaxial Fan and Mounting Ring

*a. General.* The fan supplies all air necessary for heater operation. A cast steel mounting ring supports the fan and associated parts. Power for the fan is transmitted by a flexible rubber sleeve bushing (2, fig. 25) which mates with a drive coupling on the power unit and a driven coupling half (30) which is pressed on the fan shaft bearing (16). The fan hub (17) is mounted on the fan and is pressed on the fan shaft bearing. On Model BT400-40-1 heaters the hinge support bracket (fig. 27) must be removed to gain access to the fan mounting ring.

### *b. Removal (BT400-40)*

- (1) Refer to paragraph 12 and remove the power unit.
- (2) Remove drive V-belt (29, fig. 25) by slipping V-belt from pulleys.
- (3) Remove three screws and lockwashers (fig. 26) securing mounting ring to casing.
- (4) Remove two screws and remove exhaust pipe bracket and spacers. Remove mounting ring with attached fan and pulley from heater.
- (5) Remove three screws (21, fig. 25) and lockwashers (20) and remove vaneaxial fan (28) from fan hub (17).



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- |   |   |
|---|---|
| 1 Coupling sleeve                                     | 17 Fan hub                                  |
| 2 Sleeve bushing                                      | 18 Vaneaxial fan                            |
| 3 Screw, machine, No. 6-32 x 5/16 in. (4)             | 19 Air straightening vane                   |
| 4 Washer, lock, No. 6 (4)                             | 20 Washer, lock, IT, 1/4 in. (3)            |
| 5 Retainer (2)  | 21 Screw, cap, hex hd, 1/4-20 x 1/2 in. (3) |
| 6 Fan bearing support                                 | 22 Nut, self-locking, hex No. 8-32 (2)      |
| 7 Resilient mount                                     | 23 Washer, lock, No. 8 (2)                  |
| 8 Screw, machine, No. 8-32 x 1 1/8 in. (2)            | 24 Screw, cap, hex hd, 5/16-18 x 1 in. (4)  |
| 9 Fan ring  | 25 Washer, lock, 5/16 in. (4)               |
| 10 Fan guard (3)                                      | 26 Screw, machine, No. 8-32 x 1/2 in. (2)   |
| 11 Screw, machine, 1/4-20 x 1/2 in.                   | 27 Screw, machine, 1/4-20 x 1-1/2 in. (2)   |
| 12 Washer, lock, 1/4 in.                              | 28 Washer, flat 1/4 in. (2)                 |
| 13 Thumb screw (3)                                    | 29 V-belt, drive                            |
| 14 Screw, cap, hex hd, 1/4-20 x 1/2 in (3) (BT400-40) | 30 Coupling half                            |
| 15 Washer, lock IT, 1/4 in. (3) (BT400-40)            | 31 Nut, plain, hex, 1/4-20 (2)              |
| 16 Fan shaft bearing                                  | 32 Washer, lock IT, 1/4 in. (2)             |

Figure 25. Fan and mounting ring, exploded view.

- |   |   |
|---|---|
| (6) Remove fan hub from fan shaft bearing (16), using a suitable puller.  | mounting ring. Remove thumb screw (13).   |
| (7) Remove three screws (11 and 27), lockwashers (12 and 32), two nuts (31), two flat washers (28), and remove three fan guards (10) from | (8) Remove screws (26), self-locking nuts (22), and lockwashers (23) and remove air straightening vane (19) from mounting ring. |

- (9) Remove four screws (3) and lockwashers (4) and remove two retainers (5). Remove flexible rubber sleeve bushing (2) from coupling half (30).
- (10) Remove driven coupling from fan shaft bearing (16), using a suitable puller.
- (11) Remove two screws (8) and remove resilient mount (7) from fan bearing support (6).
- (12) Remove four screws (24) and lockwashers (25) and remove fan bearing support (6) from mounting ring.
- (13) Remove fan shaft bearing (16) from bearing support.

*c. Removal (BT400-40-1).*

- (1) Refer to paragraph 12 and remove the power unit.
- (2) Remove drive V-belt (29, fig. 25) by slipping V-belt from pulleys.
- (3) Remove four screws, lockwashers, and nuts securing door supports (fig. 27) to cabinet.
- (4) Remove three screws and lockwashers securing hinge support bracket to mounting ring and mounting ring to casing.
- (5) Proceed to paragraph b. above and continue removal procedure in accordance with steps (4) through (13).

*d. Cleaning, Inspection, and Repair.*

- (1) Clean all parts, except flexible rubber sleeve bushing (2) with an approved solvent and dry thoroughly.
- (2) Inspect fan for cracks or broken blades, distortion, and other damage. Replace a damaged fan.
- (3) Inspect fan hub for cracks and distortion. Replace a damaged hub.
- (4) Inspect mounting ring for breaks, cracks, and other damage. Weld breaks or cracks. Replace the mounting ring if it is damaged.

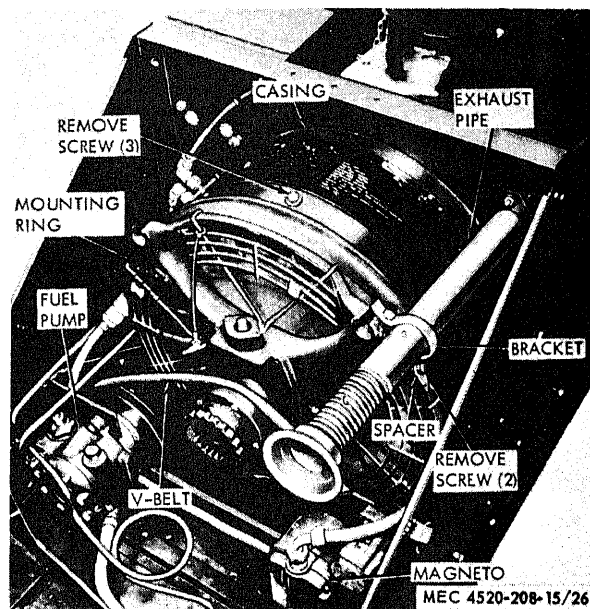


Figure 26. Fan mounting ring removal points (BT400-40).

- (5) Inspect air straightening vane (19) for cracks or bent condition. Straighten to proper configuration if possible. Replace unserviceable damaged vanes.
- (6) Inspect coupling half (30) for cracks and damaged teeth. Replace damaged coupling.
- (7) Inspect flexible rubber sleeve bushing for broken teeth, distortion, deterioration and cracks. Replace damaged coupling sleeve or sleeve bushing.
- (8) Inspect resilient mount for damage and hardening of cushion. Replace damaged or hardened resilient mount.

*e. Installation (BT400-40).*

- (1) Install fan shaft bearing (16) in fan bearing support (6). Press coupling half (30) on end of bearing.
- (2) Position bearing support on fan ring (9) and secure with four screws (24) and lockwashers (25).
- (3) Install air straightening vane (19) in mounting ring and secure with two screws (26), lockwashers (23), and self-locking nuts (22).

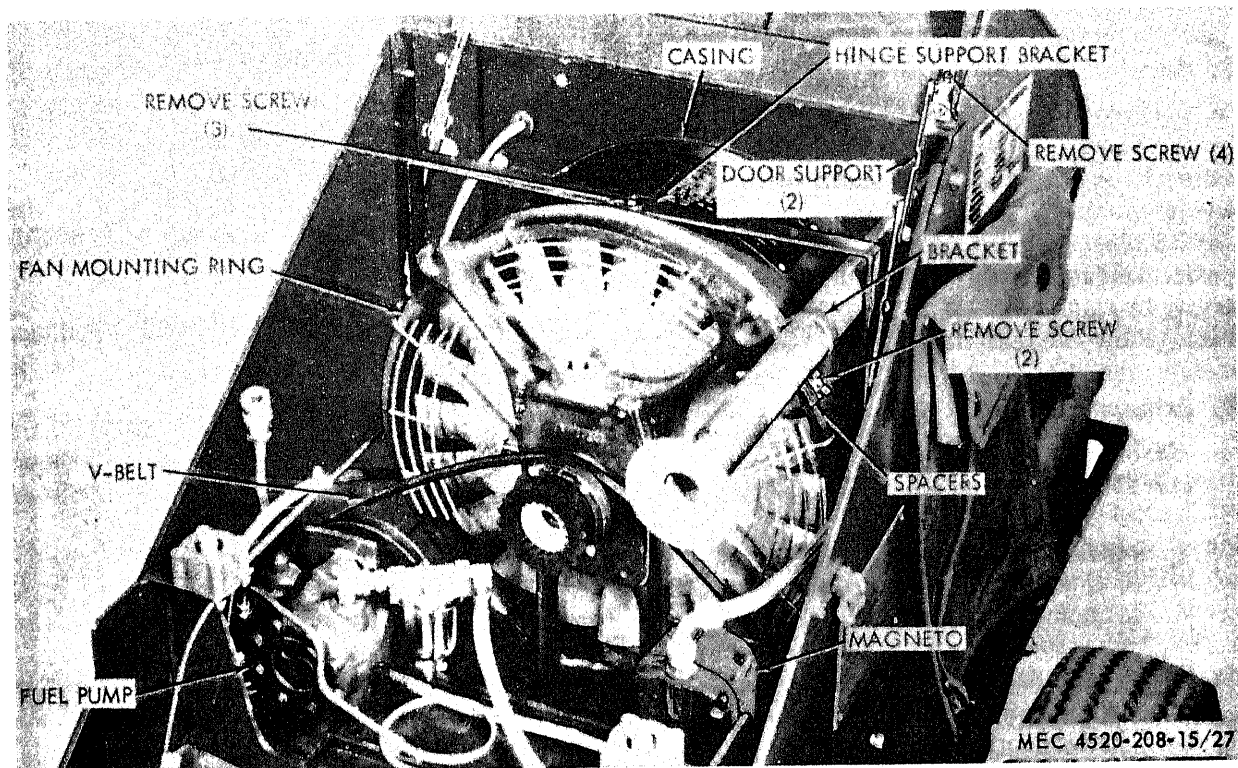


Figure 27. Fan mounting ring, removal points (BT400-40-1).

- (4) Press fan hub (17) on bearing. Install vaneaxial fan (18) on hub and secure with three cap screws (21) and lockwashers (20).
  - (5) Position resilient mount (7) on fan bearing support (6) and secure with two screws (8). Install three fan guards (10) and secure with three screws (11 and 27), lockwashers (12 and 32), two flat washers (28) and nuts (31).
  - (6) Install coupling sleeve (1) in flexible rubber sleeve bushing (2) and place sleeve bushing in coupling half (30). Install two retainers (5) and secure with four screws (3) and lockwashers (4).
  - (7) Install fan ring, with attached parts, in casing and secure with three screws (14) and lockwashers (15).
  - (8) Install bracket and spacers (fig. 26) using two screws.
  - (9) Install V-belt (para 76).
  - (10) Refer to paragraph 12 and install power unit.
- f. Installation (BT400-40-1).
- (1) Perform steps (1) through (6) of paragraph e. above.
  - (2) Install mounting ring in casing. Line up center hole in casing with center hole in mounting ring.
  - (3) Install hinge support bracket with attached door supports (fig. 27) and secure with three screws and lockwashers.
  - (4) Connect door supports to cabinet and secure with four screws, lockwashers, and nuts.
  - (5) Install V-belt (para 76).
  - (6) Refer to paragraph 12 and install power unit.



## Section X. HEATER EXHAUST SYSTEM

## 78. General

a. Exhaust gages from the heater pass from the combustion chamber through the heat exchanger and into the atmosphere through the exhaust stack.

b. Exhaust gages from the gasoline engine power unit exhaust manifold muffler are carried by the engine exhaust pipe (19, fig. 24) to the heater exhaust pipe.

## 79. Exhaust Pipes

## a. General.

- (1) The engine exhaust pipe (19, fig. 24) is connected to the engine muffler pipe. The outlet end of the pipe has a flange. When the gasoline engine is mounted on the heater, the engine exhaust pipe mates with the exhaust conductor (22, fig. 49) with the spring loaded flange (23) forming a gastight fitting.
- (2) The exhaust pipe passes through a flange in the bulkhead and is attached to the exhaust stack. A sheet metal shield surrounds the exhaust pipe outside the cabinet to prevent accidental burns to personnel.

## b. Removal.

- (1) Refer to paragraph 12 and remove the power unit from the heater.

**Warning:** Allow heater and power unit to cool off before attempting to remove any part of the exhaust system.

- (2) Remove two screws (30, fig. 24) flat washers (31), lockwashers (33), and nuts (34) and remove exhaust pipe (19) and gasket (32) from power unit.
- (3) Remove two taper pins (fig. 28) and remove flange, spring, and exhaust pipe connection.
- (4) Remove three screws, nuts, flat washers, and lockwashers securing publications case to heaters and remove case.
- (5) Refer to figure 28 and remove two screws, lockwashers, and nuts secur-

ing exhaust shield to bulkhead and one screw and two flat washers securing exhaust shield to exhaust stack. Remove exhaust shield.

- (6) Remove two screws, two lockwashers, and two nuts securing exhaust pipe flange to bulkhead.
- (7) Remove two screws, flat washers, and lockwashers and remove bracket and spacers securing exhaust pipe to fan mounting ring.
- (8) Remove two screws, flat washers, and self-locking nuts securing exhaust pipe to exhaust stack. Remove exhaust pipe.

## c. Cleaning, Inspection, and Repair.

- (1) Clean all parts, except gasket, in an approved cleaning solvent and dry thoroughly.
- (2) Inspect parts for bends, breaks, cracks, lack of spring tension, torn gasket, or other damage.
- (3) Straighten all minor bends and weld small breaks or cracks. Replace all unserviceable parts.

## d. Installation.

- (1) Position the exhaust pipe on exhaust stack (fig. 28) with exhaust pipe extending through hole in bulkhead. Secure exhaust pipe to exhaust stack with two cap screws, flat washers, and selflocking nuts.

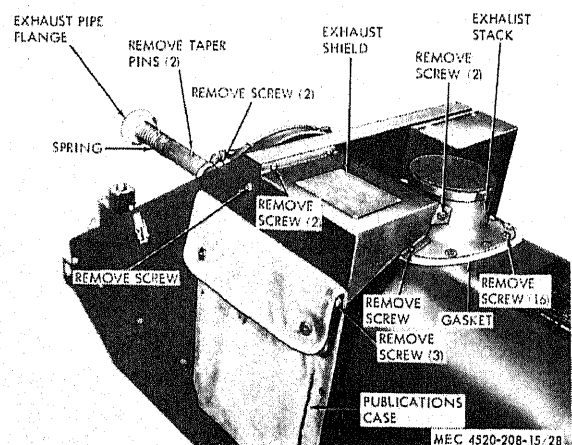


Figure 28. Exhaust system, removal points.

- (2) Install exhaust pipe flange around exhaust pipe and secure flange to bulkhead with two screws, lockwashers, and two nuts.
- (3) Position exhaust pipe over mounting ring, install bracket and spacers, and secure with two screws, flat washers, and lockwashers.
- (4) Position exhaust shield over exhaust pipe between bulkhead and exhaust stack. Secure exhaust shield to exhaust stack with one screw and two flat washers. Secure exhaust shield to bulkhead with two screws, two washers, and two nuts.
- (5) Install flange on exhaust pipe conductor, install spring on conductor, slide conductor into exhaust pipe and secure with two taper pins.
- (6) Install publication case on heater and secure with three screws, nuts, flat washers, and lockwashers.
- (7) Refer to figure 24 and install gasket (32) and exhaust pipe (19) on gasoline engine power unit. Secure exhaust pipe with two screws (30), flat washers (31) lockwashers (33), and nuts (34).
- (8) Refer to paragraph 12 and install power unit on heater.

## 80. Exhaust Stack and Pipe Extensions

*a. General.* The exhaust stack extends from the top center of the heater casing. When not in operation, keep stack cover on exhaust

stack. Before operation, remove exhaust stack cover and install two exhaust pipes (1 and 2, fig. 10) to disperse exhaust gases to the atmosphere.

### *b. Removal.*

- (1) Remove exhaust pipe from heater as described in paragraph 79.
- (2) Refer to figure 28 and remove exhaust stack cover from exhaust stack. Remove sixteen screws and flat washers securing exhaust stack to casing and remove exhaust stack and asbestos gasket.

### *c. Cleaning, Inspection, and Repair.*

- (1) Clean all parts, except gasket, in approved solvent and dry thoroughly.
- (2) Inspect all parts for breaks, cracks, dents, enlarged screw holes, torn gaskets, and other damage. Inspect exhaust pipes (1 and 2, fig. 10) for burned or damaged spark arrestor screen.
- (3) Straighten minor dents and bends. Replace all damaged parts.

### *d. Installation.*

- (1) Refer to figure 28 and install gasket and exhaust stack on heater and secure with sixteen screws and lockwashers.
- (2) Secure exhaust stack cover chain under one screw. Install exhaust stack cover on stack.
- (3) Refer to paragraph 79 and install exhaust pipe on heater.

## Section XI. HEATER IGNITION SYSTEM

### 81. General

Components of ignition system are the heater magneto, ignition cable, and the igniter plug.

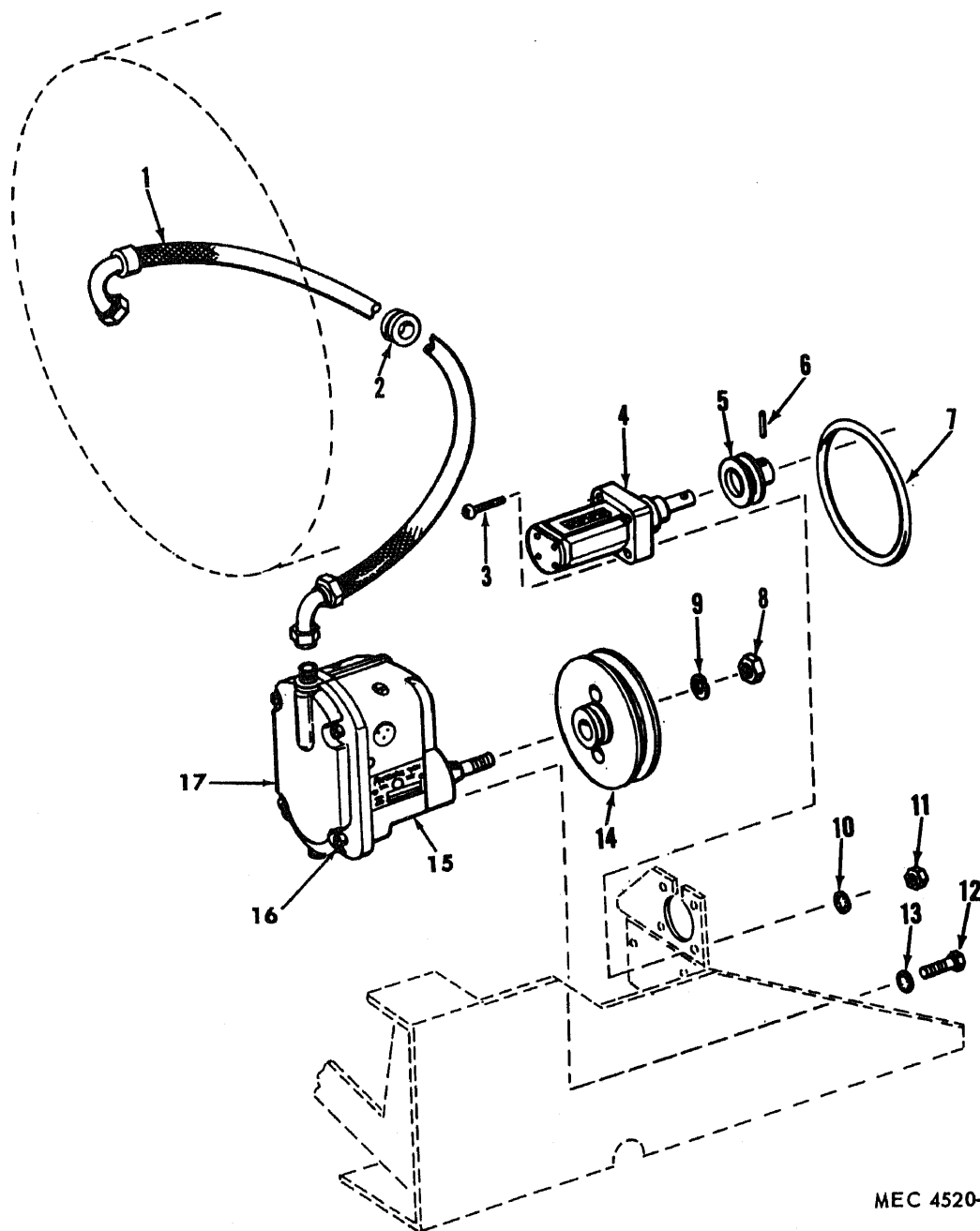
### 82. Heater Magneto

*a. General.* The heater magneto is mounted on a bracket installed at left side of heater. The magneto is driven by the V-belt.

#### *b. Adjustment.*

- (1) Refer to paragraph 12 and remove the power unit.

- (2) Refer to figure 29 and remove four screws and lockwashers securing end cap (17) to the magneto (15). Remove the end cap and cap gasket, contact, and ignition cable (1).
- (3) Move the V-belt to rotate the magneto pulley (5) until the breaker arm (4, fig. 30) is riding on the high point of the cam (6).
- (4) Insert a feeler gage between the points (5). The gap should be between 0.015 and 0.018-inch.

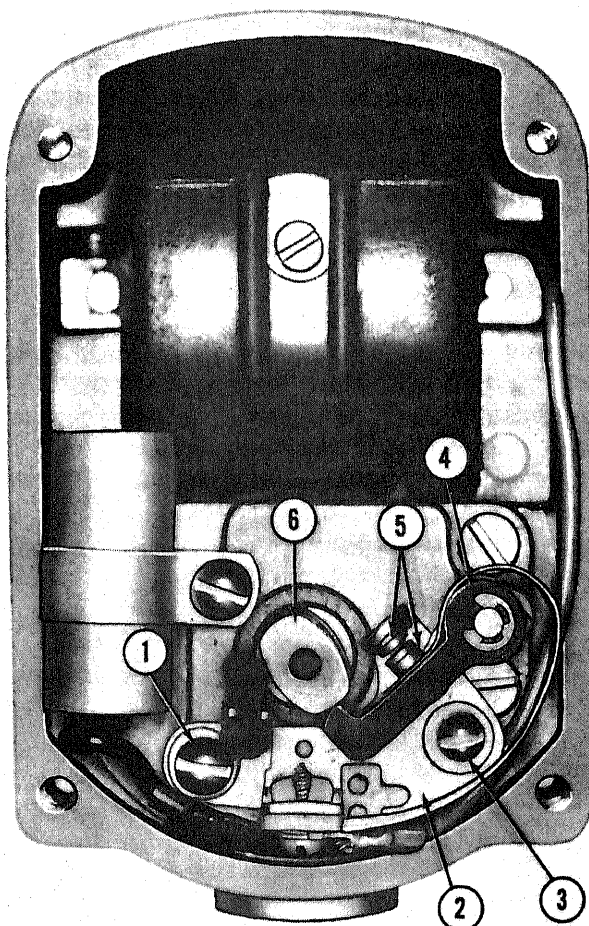


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- |  |  |
|--|--|
| 1 Ignition cable                       | 10 Washer, lock, 1/4 in. (4)               |
| 2 Grommet                              | 11 Nut, plain, hex, No. 10-24 (4)          |
| 3 Screw, machine, No. 10-24 x 1 (4)    | 12 Capscrew, hex hd, 1/4-20 x 1/2 in. (4)  |
| 4 Time totalizing meter                | 13 Washer, lock, No. 10 (4)                |
| 5 Pulley, meter                        | 14 Pulley, magneto                         |
| 6 Spring pin                           | 15 Magneto, ignition                       |
| 7 Meter drive belt (preformed packing) | 16 Screw, machine, No. 10-24 x 5/8 in. (4) |
| 8 Nut, plain, hexagon, 3/8-16          | 17 End cap                                 |
| 9 Washer, lock, 3/8 in.                |  |

Figure 29. Magneto and time totalizing meter, exploded view.

- (5) Loosen the screws (1 and 3) and adjust the points by moving the bracket (2) until the gap is correct. Tighten the screws and recheck the gap.
- (6) Position the contact, gasket, and end cap (17, fig. 29), with the ignition cable attached, on the magneto. Secure end cap with four screws and lockwashers.
- (7) Refer to paragraph 12 and install the power unit.



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- 1 Screw, machine, No. 8-32 x 3/8 in.
- 2 Bracket
- 3 Screw, machine, No. 6-32 x 3/8 in.
- 4 Breaker arm
- 5 Points
- 6 Cam

Figure 30. Heater magneto point adjustment.

*c. Removal.*

- (1) Refer to paragraph 12 and remove the power unit.
- (2) Disconnect the ignition cable connector (1, fig. 29) from the end cap. Remove the V-belt from the pulleys.
- (3) Remove nut and washers securing magneto pulley (14) to magneto shaft.
- (4) On Model BT400-40 heaters, remove pulley and time totalizing meter drive belt (preformed packing) (7) from magneto.
- (5) On Model BT400-40-1 heaters, remove magneto pulley from magneto.
- (6) Remove four cap screws (12) and lockwashers (13) and remove magneto (15) from mounting bracket.
- (7) Remove end cap (b above).

*d. Cleaning and Inspection.*

- (1) Clean the magneto with a cloth dampened in approved cleaning solvent and dry thoroughly.
- (2) Inspect points for burning or pitting. Dress the points with a fine mill file or point dresser. Replace points if badly worn or burned.
- (3) Inspect hardware and gasket for damage. Replace damaged parts.

*e. Installation.*

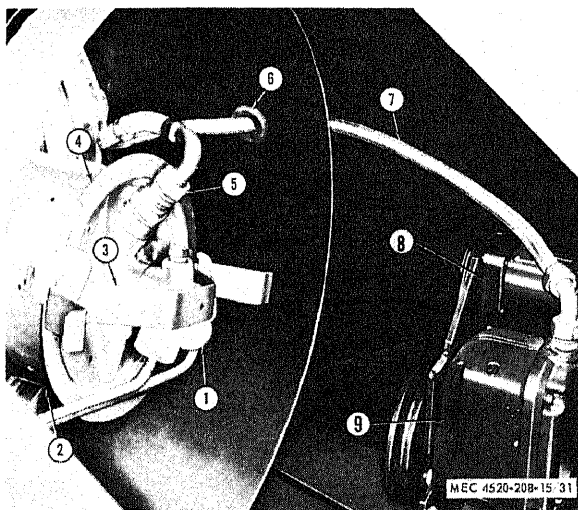
- (1) Install the end cap (b above).
- (2) Position magneto on mounting bracket and secure with four cap screws and lockwashers.
- (3) Install magneto pulley (14) on magneto shaft and secure with nut and washer.
- (4) On Model BT400-40 heaters, connect time totalizing meter drive belt (4) over magneto pulley and meter pulley.
- (5) Install drive belt on fuel pump, fan, and magneto pulleys.
- (6) Connect ignition cable connector to end cap.
- (7) Refer to paragraph 12 and install the power unit.

### 83. Ignition Cable, Igniter Plug, and Combustor Plate

a. *General.* The igniter plug produces the spark necessary for fuel ignition within the combustor. Electrical current flows from the magneto to the igniter plug through the ignition cable.

#### b. Removal.

- (1) Refer to paragraph 12 and remove the power unit.
- (2) Refer to paragraph 77 and remove the fan mounting ring.
- (3) Disconnect the ignition cable (7, fig. 31) from igniter plug (5) and magneto (9).
- (4) Remove grommet (6) from casing and remove ignition cable.
- (5) Remove igniter plug (5) from combustor plate (4).
- (6) Disengage clamp (3) from notches in combustor (2).



- 1 Nozzle holder
- 2 Combustor
- 3 Clamp
- 4 Plate
- 5 Igniter plug
- 6 Grommet
- 7 Ignition cable
- 8 Time totalizing meter (BT400-40)
- 9 Magneto

Figure 31. Combustor plate, nozzle and ignition cable, removal points.

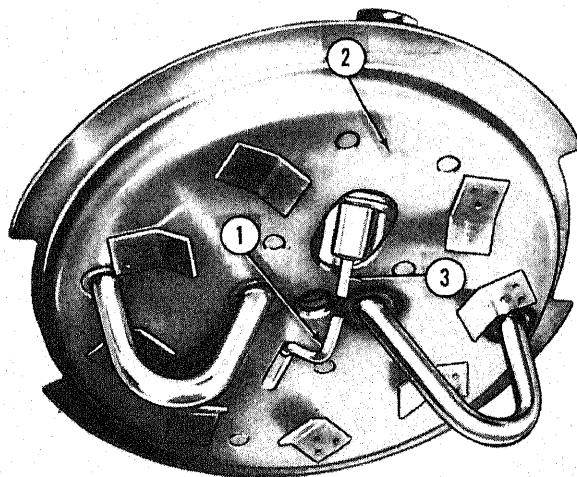
- (7) On Model BT400-40 heaters, remove two connectors from elbows and tube assemblies, and remove plate.
- (8) On Model BT400-40-1 heaters, remove clamp and nozzle holder from plate (4) and remove plate.

#### *Cleaning and Inspection.*

- (1) Clean the igniter plug and ignition cable with a cloth dampened in an approved cleaning solvent and dry thoroughly.
- (2) Inspect igniter plug for burning or pitting, cracks, or other damage. Clean the points with fine emery cloth and polish with crocus cloth. Replace a cracked or damaged igniter plug.
- (3) Inspect ignition cable for breaks, damaged threads, or frayed or broken insulation. Replace damaged ignition cable.

#### d. Installation.

- (1) Install the igniter plug (5) in the plate (4). Measure the point gap. The gap should be 0.125 to 0.1875 inch. Bend the electrode (1, fig. 3) on the plate (2) to obtain correct gap.



- 1 Electrode
- 2 Plate
- 3 Igniter plug electrode

Figure 32. Igniter plug, adjustment points.

**Caution:** Do not bend the igniter plug electrode (3).

- (2) Install the plate (4, fig. 31) on combustor (2).
- (3) On Model BT400-40 heaters, insert nozzle holder (1) in bore of plate, tighten tube assembly fittings, and install clamp (3) in notches on combustor to secure nozzle.
- (4) On Model BT400-40-1 heaters, insert nozzle holder (1), with clamp at-

tached, in bore of plate. Secure nozzle holder by engaging clamp (3) in notches on combustor.

- (5) Insert ignition cable (7) through hole in casing, and secure grommet (6) around cable. Connect ignition cable to igniter plug (5) and magneto (9).
- (6) Refer to paragraph 77 and install the mounting ring.
- (7) Refer to paragraph 12 and install the power unit.

## Section XII. HEATER FUEL SYSTEM (BT400-40)

### 84. General

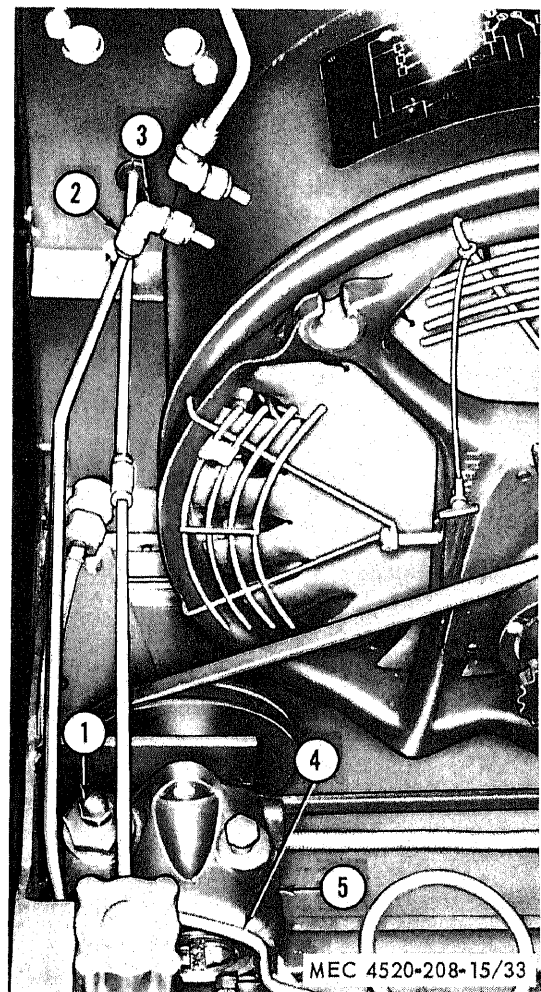
The heater fuel system consists of a fuel tank mounted in the base, fuel filter, tube assemblies, fuel pump, fuel control box, and combustor.

### 85. Fuel Pump and Heater Fuel Tube Assemblies

*a. General.* The fuel pump is mounted on a bracket to the left of the nozzle. The pump is belt-driven by the power unit. A flexible hose assembly delivers fuel, through the fuel filter, to the fuel pump. During the heating cycle fuel travels from the nozzle and secondary bypass line. Bypass fuel is returned to the fuel tank from the nozzle and secondary bypass line.

#### *b. Pressure Test and Adjustment.*

- (1) Disconnect fuel pump-to-nozzle pressure tube assembly (2, fig. 33) from elbow (3).
- (2) Using an adapter, connect a pressure gage with a maximum reading 200 psi in pressure tube assembly (2).
- (3) Refer to paragraph 12 and install power unit. Refer to paragraph 32 and start the heater and observe pressure gage reading. The pump should be operating at 150 psi, plus or minus 2 psi.
- (4) If the reading is not within operating pressure tolerance, remove nut (1) and turn adjusting screw clockwise to increase the pressure, or counterclockwise to decrease pressure.
- (5) Stop the heater (para 33). Remove the pressure gage and connect the pressure tube assembly (2).



- 1 Nut
- 2 Pressure tube assembly
- 3 Elbow
- 4 Bypass tube assembly
- 5 Fuel pump

Figure 33. Fuel pump, pressure test points (BT400-40).

*c. Flow Test.*

- (1) Remove the power unit (para 12).
- (2) Disconnect fuel pump-to-fuel tank bypass tube assembly (4, fig. 33) from fuel tank. Disconnect tube assembly entering fuel tank adjacent to fuel cap. Connect a flexible tube or hose to fuel tube assemblies. Install power unit (para 12).
- (3) Obtain two liquid containers, each having at least a one gallon capacity. Place hose or flexible tubes leading from tube assemblies in unmarked container.
- (4) Close the damper (fig. 13) by loosening and moving handwheel all the way to the left (when facing discharge end).
- (5) Set the temperature selector indicator knob (fig. 11) for a discharge air temperature of 150°F. Start the heater (para 34) and adjust temperature selector indicator knob as necessary until discharge air temperature is stable at 150°F.
- (6) When the temperature is stable, transfer the hose or flexible tubes to the measuring container. Record the time necessary for a flow of one gallon. Stop the heater (para 33).
- (7) If the time required to measure one gallon of flow is more than five minutes, replace the fuel pump.
- (8) Remove the power unit (para 12). Disconnect hose or flexible tubes from fuel lines and connect tube assemblies to fuel tank.
- (9) Refer to paragraph 12 and install the power unit.

*d. Removal.*

- (1) Refer to paragraph 12 and remove the power unit. Remove V-belt from pulleys.
- (2) Disconnect filter-to-pump metal hose assembly (50, fig. 34) from fluid filter (47). Disconnect pump-to-tank tube assembly (48) from straight adapter (34) at tank.
- (3) Disconnect fuel pump-to-casing tube assembly (55) at flexible elbow (62).

Disconnect pump-to-coupling tube assembly (54) at coupling (56).

- (4) Remove two screws (58) and flat washers (57) securing fuel pump assembly (52) to bracket. Remove fuel pump, with attached tube assemblies, from heater.
- (5) Disconnect tube and hose assemblies (48, 50, 54, and 55) from fuel pump. Remove three pipe elbows (49 and 51) from fuel pump. Remove straight adapter (53) from fuel pump.
- (6) Remove setscrew (36) and remove fuel pump groove pulley (35) from fuel pump.

*e. Cleaning and Inspection.*

- (1) Clean all parts in an approved cleaning solvent and dry thoroughly.
- (2) Inspect all parts for evidence of leaking, breaks, cracks, damaged threads, restriction of movement, or other damage. Replace all damaged parts.

*f. Installation.*

- (1) Position fuel pump groove pulley (35) on fuel pump shaft and secure with setscrew (36).
- (2) Install straight adapter (53) in fuel pump assembly (52). Install three pipe elbows (49 and 51) in fuel pump.
- (3) Connect tube and hose assemblies (48, 50, 54, and 55) in elbows and connector.
- (4) Position fuel pump assembly (52), with attached tube assemblies, on mounting bracket. Secure fuel pump with two screws (58) and flat washers (57). Install V-belt and adjust V-belt tension (para 47).
- (5) Connect fuel pump-to-coupling tube assembly (54) to coupling (56). Connect fuel pump-to-casing tube assembly (55) to flexible elbow (62) at side of casing.
- (6) Connect pump-to-tank tube assembly (48) to straight adapter (34) at fuel tank. Connect fuel filter-to-pump metal hose assembly (50) to fluid filter (47).
- (7) Install power unit (para 12).

## 86. Power Unit Hose Assembly

*a. General.* A flexible hose assembly delivers fuel from the fuel tank to the gasoline engine power unit fuel filter. Connection at the power unit is made with a quick-disconnect coupling.

### *b. Removal.*

- (1) Refer to paragraph 12 and remove the power unit.
- (2) Refer to paragraph 85 and remove the heater fuel pump.
- (3) Remove screw (40, fig. 34) and self-locking nut (42) attaching engine fuel metal hose assembly (59) to fuel pump bracket.
- (4) Remove screw (40) and self-locking nut (42) securing hose assembly to magneto bracket. Remove two loop clamps (41) from hose assembly.
- (5) Remove quick-disconnect coupling half (60) from hose assembly.
- (6) Remove engine fuel metal hose assembly (59) from pipe elbow (43).

### *c. Cleaning and Inspection.*

- (1) Clean all parts, except clamps, in an approved solvent and dry thoroughly.
- (2) Inspect hose assembly for evidence of leaking, breaks, cracks, or damaged threads. Inspect quick-disconnect coupling for restricted movement and damage. Replace damaged parts.

### *d. Installation.*

- (1) Install engine fuel metal hose assembly (59) on pipe elbow (43).
- (2) Install loop clamps (41) on engine fuel metal hose assembly (59). Attach clamps to fuel pump and magneto brackets with two screws (40) and selflocking nuts (42).
- (3) Install fuel pump (para 85).
- (4) Install power unit (para 12).

## 87. Fuel Atomizing Nozzle

*a. General.* The fuel atomizing nozzle supplies fuel to the combustor. The atomized fuel is combined with air and ignited.

### *b. Removal.*

- (1) Remove the power unit (para 12). Remove fan mounting ring (para 77) and combustor clamp (para 83).

- (2) Disconnect nozzle holder with tube assemblies (39, fig. 34) by removing two connectors (61) from flexible elbows (62) and tube assemblies.
- (3) Remove nozzle holder and tube assemblies from heater.
- (4) Remove the nozzle (3, fig. 35) from nozzle holder.

### *c. Cleaning and Inspection.*

- (1) Clean all parts with an approved solvent and dry thoroughly.
- (2) Inspect all parts for breaks, cracks, obstructions, damaged threads, or other damage. Replace all damaged parts.

### *d. Installation.*

- (1) Install nozzle (3, fig. 35) in nozzle holder with tube assemblies (2).
- (2) Position nozzle holder with tube assemblies (39, fig. 34) on heater, with tube assemblies through holes on left side of casing. Connect tube assemblies, using two connectors (61), to flexible elbows (62) on tube assemblies.
- (3) Install clamp (3, fig. 31) on heater (para 83). Install mounting ring (para 77).
- (4) Install power unit (para 12).

## 88. Heater Fuel Filter

*a. General.* Fuel from the tank passes through an automotive type filter before entering the fuel pump. The filter cannot be disassembled or repaired. Remove and replace filter at periodic intervals.

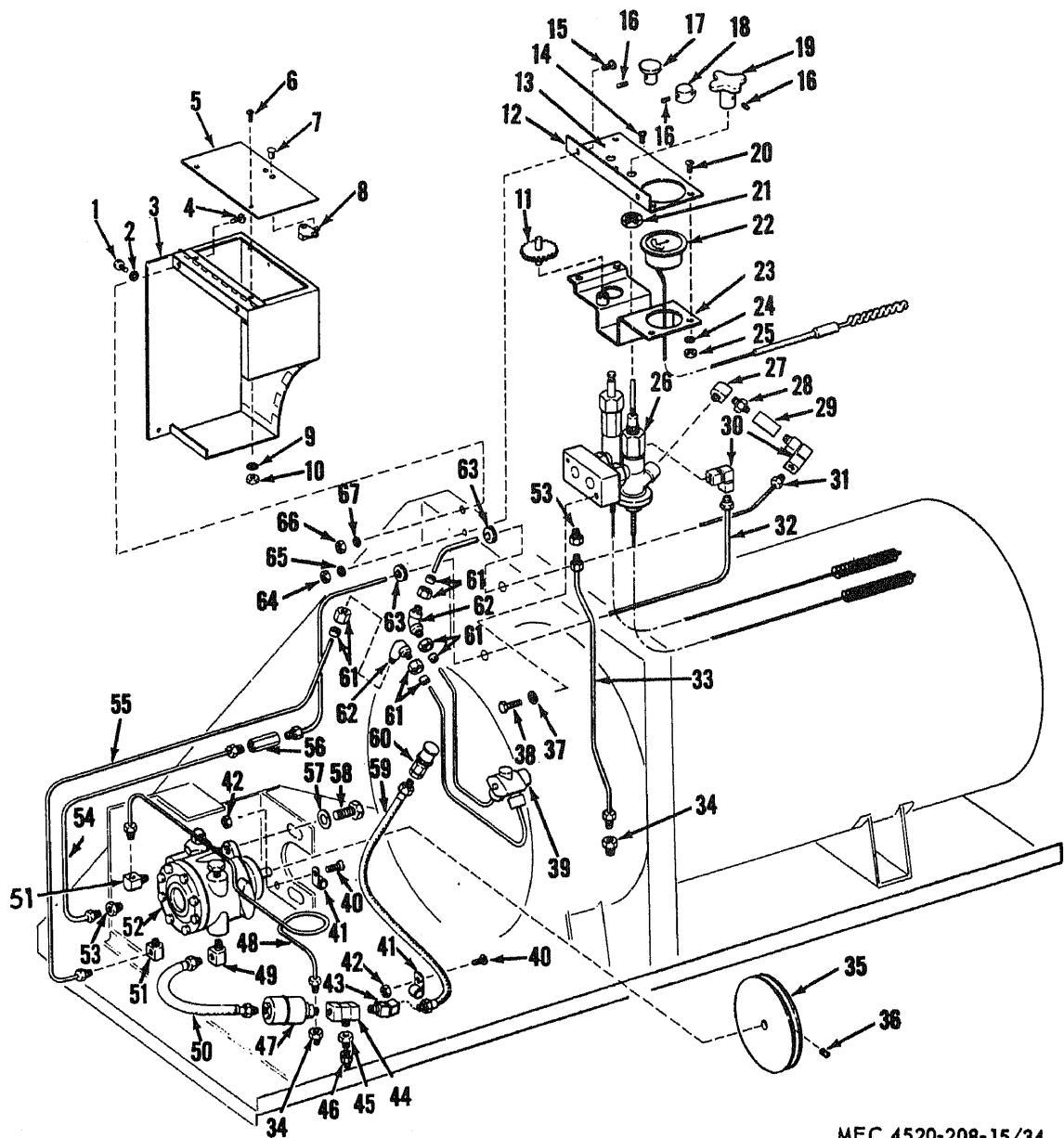
### *b. Removal.*

- (1) Remove power unit (para 12).
- (2) Disconnect filter-to-pump metal hose assembly (50, fig. 34) from fluid filter (47).
- (3) Remove fluid filter by disconnecting filter from pipe-to-tube tee (44).

### *c. Installation.*

- (1) Install fluid filter (47) by connecting inlet end of filter to pipe-to-tube tee (44).
- (2) Connect filter-to-pump metal hose assembly (50) to outlet end of filter.
- (3) Install power unit (para 12).





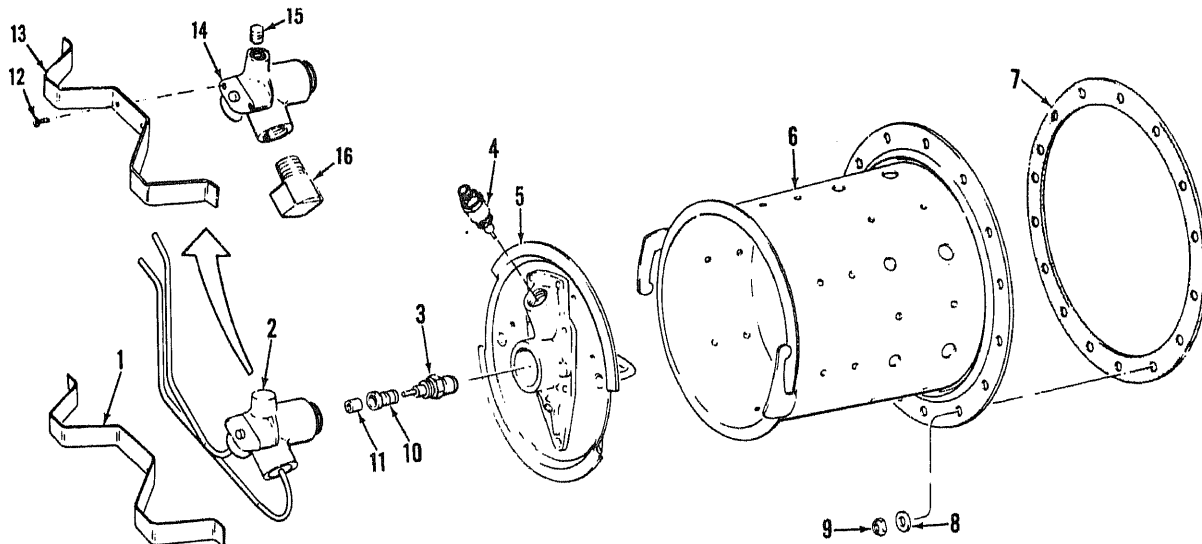
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|--|--|
| 1 Screw, cap, hex hd, 1/4-20 x 1/2 in. (2) | 11 Temperature selector gear               |
| 2 Washer, lock IT, 1/4 in. (2)             | 12 Control panel                           |
| 3 Control box                              | 13 Instruction plate                       |
| 4 Screw, machine, No. 10-24 x 3/8 in. (2)  | 14 Rivet, blind, indicator stop            |
| 5 Access door                              | 15 Screw, machine, 10-24 x 3/8 in. (2)     |
| 6 Screw, machine, No. 10-24 x 3/8 in. (2)  | 16 Setscrew, 1/4-20 x 1/4 in. (3)          |
| 7 Rivet (2)                                | 17 Fuel control valve knob                 |
| 8 Catch                                    | 18 Temperature indicator knob              |
| 9 Washer, lock IT, No. 10 (2)              | 19 Selector valve knob                     |
| 10 Nut, plain, hex, No. 10-24 (2)          | 20 Screw, machine, No. 10-24 x 3/8 in. (4) |

Figure 34. Fuel pump, tube assemblies, and fuel control, exploded view (BT400-40).

- |   |   |
|---|---|
| 21 Nut  | 45 Bushing, reducer 1/4 NPT to 1/8 NPT          |
| 22 Temperature gage                             | 46 Coupling, pipe, 1/4 NPT                      |
| 23 Bracket                                      | 47 Fluid filter (fuel)                          |
| 24 Washer, lock IT, No. 10 (4)                  | 48 Tube assembly, pump to tank                  |
| 25 Nut, plain, hex, No. 10-24 (4)               | 49 Elbow, pipe, 1/4 NPT                         |
| 26 Control valves and block (fig. 52)           | 50 Hose assembly, metal, filter to pump         |
| 27 Elbow, pipe, 1/8 NPT                         | 51 Elbow, pipe to tube, 1/8 NPT to 1/4 tube (2) |
| 28 Pipe nipple, 1/8 NPT                         | 52 Fuel pump assembly                           |
| 29 Check valve                                  | 53 Adapter, straight, 1/8 NPT to 1/4 tube       |
| 30 Elbow, pipe to tube, 1/8 NPT to 1/4 tube (2) | 54 Tube assembly, pump to coupling              |
| 31 Tube assembly, nozzle bypass to check valve  | 55 Tube assembly, pump to casing                |
| 32 Tube assembly, coupling to valve             | 56 Coupling, 1/4 tube                           |
| 33 Tube assembly, block to tank                 | 57 Washer, flat, 1/2 in. (2)                    |
| 34 Adapter, straight, 1/4 NPT to 1/4 tube (2)   | 58 Screw, cap, hex hd, 1/2-13 x 7/8 in. (2)     |
| 35 Fuel pump groove pulley                      | 59 Hose assembly, metal, engine fuel            |
| 36 Setscrew, 1/4-20 x 1/2 in.                   | 60 Coupling half, quick disconnect              |
| 37 Washer, lock IT, 1/4 in. (2)                 | 61 Connector (4) (included with item 62)        |
| 38 Screw, cap, hex hd, 1/4-20 x 1 in. (2)       | 62 Elbow, flexible, 1/4 tube (2)                |
| 39 Nozzle holder with tube assemblies           | 63 Grommet, rubber (2)                          |
| 40 Screw, machine, No. 10-24 x 5/8 in. (2)      | 64 Nut, plain, hex, No. 10-24 (2)               |
| 41 Clamp (2)                                    | 65 Washer, lock, IT, No. 10 (2)                 |
| 42 Nut, self-locking, hex, No. 10-24 (2)        | 66 Nut, plain, hex, No. 10-24 (2)               |
| 43 Elbow, pipe, 1/8 NPT                         | 67 Washer, lock IT, No. 10 (2)                  |
| 44 Tee, pipe to tube                            |   |

Figure 34—Continued.



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- |   |  |
|---|--|
| 1 Combustor Clamp (BT400-40)                    | 9 Nut, self-locking, hex, stainless, 1/4-28 (16) |
| 2 Nozzle holder with tube assemblies (BT400-40) | 10 Strainer                                      |
| 3 Nozzle (includes seal and strainer)           | 11 Seal  |
| 4 Igniter plug                                  | 12 Screw, machine, (2) (BT400-40-1)              |
| 5 Combustor plate                               | 13 Combustor clamp (BT400-40-1)                  |
| 6 Combustor assembly                            | 14 Nozzle holder (BT400-40-1)                    |
| 7 Gasket  | 15 Pipe plug (BT400-40-1)                        |
| 8 Washer, lock, 1/4 in. (16)                    | 16 Elbow, pipe (BT400-40-1)                      |

Figure 35. Nozzle and combustor, exploded view.

## Section XIII. HEATER FUEL SYSTEM (BT400-40-1)

**89. General**

The heater fuel system consists of a fuel tank mounted in the base, fuel filter, tube assemblies, fuel pump, fuel control box, and combustor.

**90. Fuel Pump and Heater Fuel Tube Assemblies**

*a. General.* The fuel pump is mounted on a bracket to the left of the nozzle. The pump is belt driven by the power unit. A flexible hose assembly delivers fuel, through the fuel filter, to the fuel pump. During the heating cycle fuel travels from the pump to the nozzle and secondary bypass line. Bypass fuel is returned to the fuel tank from the nozzle and secondary bypass line.

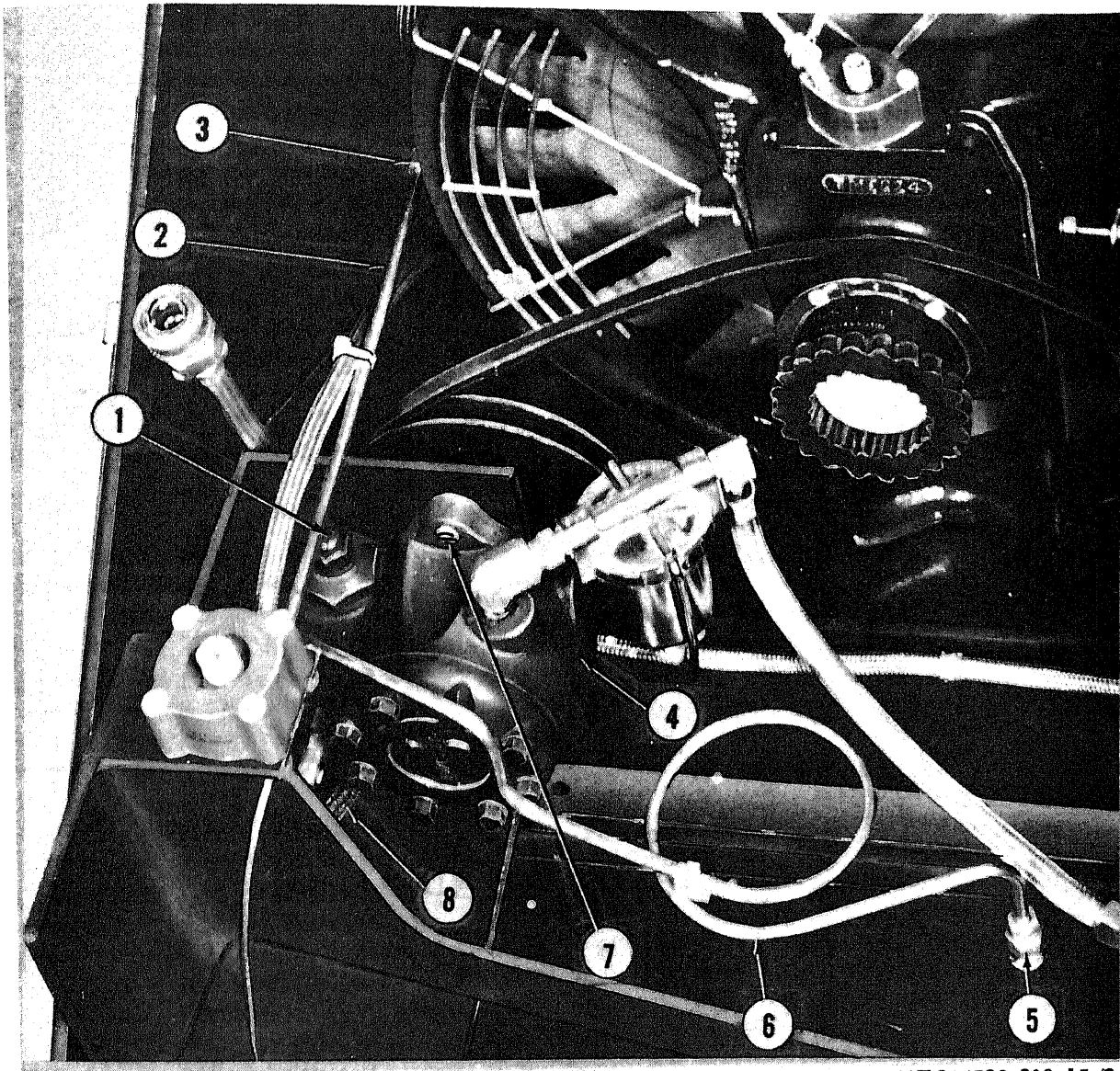
*b. Pressure Test and Adjustment.*

- (1) Remove the power unit (para 12).
- (2) Disconnect secondary bypass tube assembly (6, fig. 36) from connector (5).
- (3) Disconnect primary bypass assembly (2) from coupling (3).
- (4) Loosen two screws (7) and move fuel pump (4) toward center of heater.
- (5) Disconnect pressure hose assembly (8) from elbow on underside of fuel pump.
- (6) Connect a tee, flexible hose, and pressure gage with a maximum reading of 200 psi between elbow and pressure hose assembly (8).
- (7) Adjust V-belt (para 47) and tighten two screws (7).
- (8) Connect secondary bypass tube assembly (6) to connector (5) and primary bypass tube assembly to coupling (3).
- (9) Refer to paragraph 12 and install the power unit. Refer to paragraph 32 and start the heater, observing pressure gage reading. The pump should be operating at 150 psi, plus or minus 2 psi.
- (10) If the reading is not within operating pressure tolerance, remove nut (1) and turn adjusting screw clockwise to increase pressure, or counterclockwise to decrease pressure.

- (11) Stop the heater (para 33). Perform steps (1) through (4) above.
- (12) Disconnect pressure hose assembly (8) from tee installed in step (6) above.
- (13) Remove tee, flexible hose and pressure gage, installed in step (6) above.
- (14) Connect pressure hose assembly (8) to elbow on underside of fuel pump. Perform steps (7) and (8) above.
- (15) Refer to paragraph 12 and install the power unit.

*c. Flow Test.*

- (1) Remove the power unit (para 12).
- (2) Disconnect secondary bypass tube assembly (6, fig. 36) from fuel tank. Disconnect tube assembly entering fuel tank adjacent to fuel cap. Connect a flexible tube or hose to fuel tube assemblies. Install power unit (para 12).
- (3) Obtain two liquid containers, each having at least a one gallon capacity. Mark one container to show quantity of one gallon. Place hose or flexible tubes leading from tube assemblies in unmarked container.
- (4) Close the damper (fig 13) by loosening and moving handwheel all the way to the left (when facing discharge end).
- (5) Set the temperature selector indicator knob (fig. 11) for a discharge air temperature of 150°F. Start the heater (para 34) and adjust temperature selector indicator knob as necessary until discharge air temperature is stable at 150°F.
- (6) When the temperature is stable, transfer the hose or flexible tube to the measuring container. Record the time necessary for a flow of one gallon. Stop the heater (para 33).
- (7) If the time required to measure one gallon of flow is more than five minutes, replace the fuel pump.
- (8) Remove the power unit (para 12). Disconnect hose or flexible tube from fuel lines and connect tube assemblies to fuel tank.

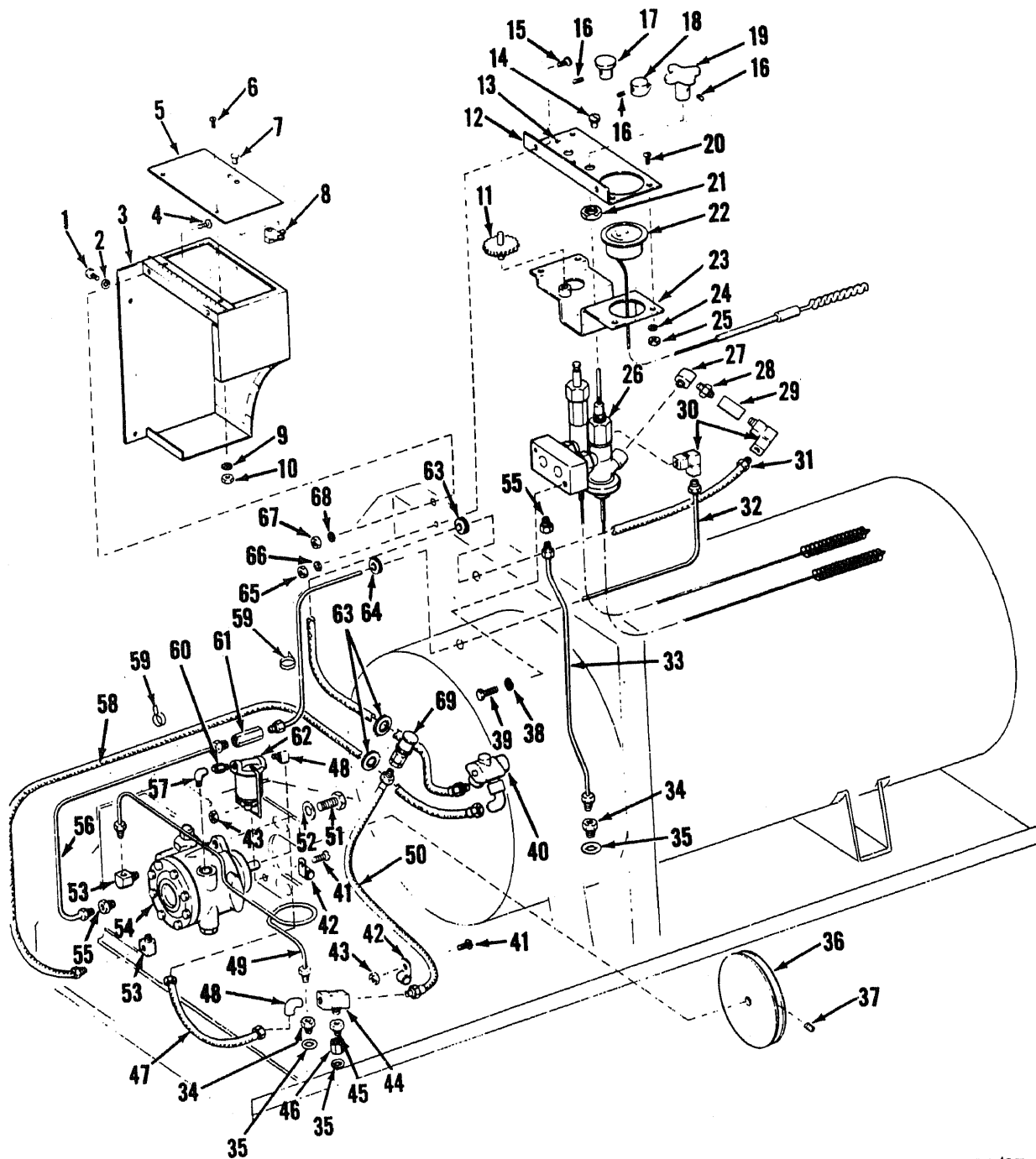


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- |                                |                                  |
|--------------------------------|----------------------------------|
| 1 Nut                          | 5 Connector                      |
| 2 Primary bypass tube assembly | 6 Secondary bypass tube assembly |
| 3 Coupling                     | 7 Screw (2)                      |
| 4 Fuel pump                    | 8 Pressure hose assembly         |

*Figure 36. Fuel pump, pressure test points (BT400-40-1).*

- (9) Refer to paragraph 12 and install the power unit.
- d. *Removal.*
- (1) Remove power unit and V-belt (para 76).
  - (2) Disconnect fuel hose assembly (47, fig 37) from pipe elbow (48).
  - (3) Disconnect primary bypass pump-to-coupling tube assembly, (56) from coupling (61).
  - (4) Disconnect pump-to-tank tube assembly (49) from connector (34).
  - (5) Remove cable tie clamp (59) securing pump-to-nozzle hose assembly (58) to



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- |  |   |
|--|---|
| 1 Screw, cap, hex hd, 1/4-20 x 1/2 in. (3) | 6 Screw, machine, No. 10-24 x 3/8 in. (2) |
| 2 Washer, lock, IT, 1/4 in. (3)            | 7 Rivet, tubular (2)                      |
| 3 Control box                              | 8 Catch                                   |
| 4 Screw, machine, No. 10-24 x 3/8 in. (2)  | 9 Washer, lock, IT, No. 10 (2)            |
| 5 Access door                              | 10 Nut, plain, hex, No. 10-24 (2)         |

Figure 37. Fuel pump, tube assemblies, and fuel control, exploded view (BT400-40-1).

- |   |   |
|---|---|
| 11 Temperature selector gear                    | 40 Nozzle holder, with elbow                    |
| 12 Control panel                                | 41 Screw, machine, No. 10-24 x 5/8 in. (2)      |
| 13 Instruction plate                            | 42 Loop clamp (2)                               |
| 14 Rivet, blind; indicator stop                 | 43 Nut, self-locking, hex, No. 10-24 (2)        |
| 15 Screw, machine, 10-24 x 3/8 (2)              | 44 Tee, pipe to tube                            |
| 16 Setscrew, 1/4-20 x 1/4 in. (3)               | 45 Bushing, reducer, 1/4 NPT to 1/8 NPT         |
| 17 Fuel control valve knob                      | 46 Coupling, pipe                               |
| 18 Temperature indicator knob                   | 47 Fuel hose assembly                           |
| 19 Selector valve knob                          | 48 Elbow, pipe (2)                              |
| 20 Screw, machine, No. 10-24 x 3/8 in. (4)      | 49 Tube assembly, pump to tank                  |
| 21 Nut  | 50 Hose assembly, metal, engine fuel            |
| 22 Temperature gage                             | 51 Screw, cap, hex hd, 1/2-13 x 7/8 in. (2)     |
| 23 Bracket                                      | 52 Washer, flat, 1/2 in. (2)                    |
| 24 Washer, lock, IT, No. 10 (4)                 | 53 Elbow, pipe to tube, 1/8 NPT to 1/4 tube (2) |
| 25 Nut, plain, hex, No. 10-24 (4)               | 54 Fuel pump assembly                           |
| 26 Control valves and block (fig. 52)           | 55 Adapter, straight, 1/8 NPT to 1/4 tube (2)   |
| 27 Elbow, pipe, 1/8 NPT                         | 56 Tube assembly, pump to coupling              |
| 28 Pipe nipple, 1/8 NPT                         | 57 Elbow, pipe                                  |
| 29 Check valve                                  | 58 Hose assembly, pump to nozzle                |
| 30 Elbow, pipe to tube, 1/8 NPT to 1/4 tube (2) | 59 Cable tie clamp (2)                          |
| 31 Hose assembly, nozzle to check valve         | 60 Reducer, pipe                                |
| 32 Tube assembly, coupling to valve             | 61 Coupling, 1/4 tube                           |
| 33 Tube assembly, block to tank                 | 62 Fluid filter (fuel)                          |
| 34 Adapter, straight, 1/4 NPT to 1/4 tube (2)   | 63 Grommet, rubber (3)                          |
| 35 Gasket (3)                                   | 64 Grommet, rubber                              |
| 36 Fuel pump groove pulley                      | 65 Nut, plain, hex, No. 10-24 (2)               |
| 37 Setscrews, 1/4 - 20 x 1/2 in.                | 66 Washer, lock, IT, No. 10 (2)                 |
| 38 Washer, lock, IT, 1/4 in. (2)                | 67 Nut, plain, hex, No. 10-24 (2)               |
| 39 Screw, cap, hex hd, 1/4-20 x 1 in. (2)       | 68 Washer, lock, IT, No. 10 (2)                 |
|   | 69 Coupling, half, quick-disconnect             |

Figure 37—Continued.

primary bypass, pump-to-coupling tube assembly (56).

- (6) Remove two screws (51) and flat washers (52) securing fuel pump to bracket.
- (7) With fuel pump partially removed from heater, disconnect pump-to-nozzle hose assembly (58) from elbow (53).
- (8) Remove fuel pump, with attached filter and tube assemblies from heater.
- (9) Disconnect pump-to-coupling tube assembly (49) from fuel pump.
- (10) Remove pipe elbow (57), pipe reducer (60) and fluid filter (62) from fuel pump.
- (11) Remove two pipe to tube elbows (53) and straight adapter (55) from fuel pump.
- (12) Remove setscrew (37) and remove fuel pump groove pulley (36) from fuel pump.

*e. Cleaning and Inspection.*

- (1) Clean all parts in an approved cleaning solvent and dry thoroughly.
- (2) Inspect all parts for evidence of leaking, breaks, cracks, damaged threads, restriction of movement, or other damage. Replace all damaged parts.

*f. Installation.*

- (1) Position fuel pump groove pulley (36 fig. 37) on fuel pump shaft and secure with setscrew (37).
- (2) Install two pipe-to-tube elbows (53) and straight adapter (55) in fuel pump.
- (3) Install pipe elbow (57), pipe reducer (60), and fluid filter (62) onto fuel pump.
- (4) Connect pump-to-coupling tube assembly (56) and pump-to-tank tube assembly (49) to fuel pump fittings.
- (5) Position fuel pump assembly (54), with attached filter and tube assemblies, on mounting bracket. Connect

- pump-to-nozzle hose assembly (58) to pipe elbow (53).
- (6) Secure fuel pump with two screws (51) and flat washers (52). Install V-belt and adjust V-belt tension (para 47).
- (7) Connect pump-to-tank tube assembly (49) to straight adapter (34).
- (8) Connect primary bypass pump-to-coupling tube assembly (56) to coupling (61).
- (9) Connect fuel hose assembly (47) to pipe elbow (48).
- (10) Secure pump-to-nozzle hose assembly (58) to pump-to-coupling tube assembly (56) with cable tie clamp (59).
- (11) Install power unit (para 12).

## 91. Power Unit Hose Assembly

*a. General.* A flexible hose assembly delivers fuel from the fuel tank to the gasoline engine power unit fuel filter. Connection at the power unit is made with a quick-disconnect coupling.

### *b. Removal.*

- (1) Refer to paragraph 12 and remove the power unit.
- (2) Refer to paragraph 90 and remove the heater fuel pump.
- (3) Remove screw (41, fig. 37) and self-locking nut (43) attaching engine fuel hose assembly (50) to fuel pump bracket.
- (4) Remove screw (41) and self-locking nut (43) securing engine fuel hose assembly to magneto bracket. Remove two loop clamps (42) from hose assembly.
- (5) Remove quick-disconnect coupling half (69) from hose assembly.
- (6) Remove hose assembly from tee (44).

### *c. Cleaning and Inspection.*

- (1) Clean all parts, except clamps, in an approved solvent and dry thoroughly.
- (2) Inspect hose assembly for evidence of leaking, breaks, cracks, or damaged threads. Inspect quick-disconnect coupling for restricted movement and damage. Replace damaged parts.

### *d. Installation.*

- (1) Install engine fuel hose assembly (50) on tee (44).
- (2) Install clamps (42) on engine fuel hose assembly (50). Attach clamps to fuel pump and magneto brackets with two screws (41) and self-locking nuts (43).
- (3) Install fuel pump (para 90).
- (4) Install power unit (para 12).

## 92. Fuel Atomizing Nozzle

*a. General.* The fuel atomizing nozzle supplies fuel to the combustor. The atomizer fuel is combined with air and ignited.

### *b. Removal.*

- (1) Remove the power unit (para 12). Remove fan mounting ring (para 77).
- (2) Remove nozzle holder (14, fig. 35) from combustor plate (5) by disengaging combustor clamp (13).
- (3) Remove nozzle (3) from nozzle holder.

### *c. Cleaning and Inspection.*

- (1) Clean all parts with an approved solvent and dry thoroughly.
- (2) Inspect all parts for breaks, cracks, obstructions, damaged threads, or other damage. Replace all damaged parts.

### *d. Installation.*

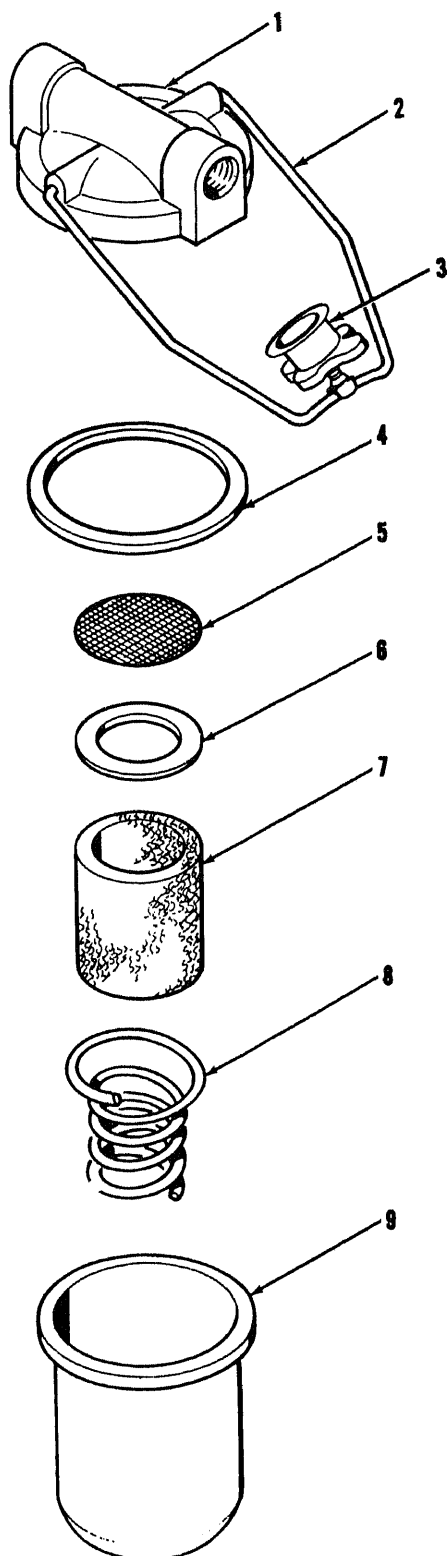
- (1) Install nozzle (3, fig. 35) in nozzle holder (14).
- (2) Install clamp (3, fig. 31) on heater (para 83). Install mounting ring (para 77).
- (3) Install power unit (para 12).

## 93. Heater Fuel Filter

*a. General.* Fuel from the tank passes through an automotive type filter before entering the fuel pump. The filter has a 40-micron replaceable element which must be removed and replaced at periodic intervals.

### *b. Servicing.*

- (1) Refer to paragraph 12 and remove the power unit.
- (2) Loosen star nut (3, fig. 38) and rotate retaining bail (2).



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Figure 38. Heater fuel filter exploded view (BT400-40-1).

- 1 Top casting
- 2 Retaining ball
- 3 Star nut
- 4 Head gasket
- 5 Element strainer
- 6 Gasket
- 7 Filter element
- 8 Filter element spring
- 9 Metal bowl

Figure 38—Continued.

- (3) Remove metal bowl (9) from top casting (1).
- (4) Remove head gasket (4), element strainer (5), and gasket (6) from top casting.
- (5) Remove filter element (7) and filter element spring (8) from metal bowl (9).
- (6) Clean screen and filter element in clean gasoline and dry with compressed air. Replace screen and filter element if defective.
- (7) Check head gasket and fibre gasket for damage or deterioration. Replace if required.
- (8) Install head gasket (4), element strainer (5), and gasket (6) in top casting (1).
- (9) Install filter element spring (8) and filter element (7) in metal bowl (9).
- (10) Install bowl to top casting and secure with retaining ball and star nut.
- (11) Install power unit (para 12).

c. Removal.

- (1) Refer to paragraph 12 and remove the power unit.
- (2) Disconnect fuel hose assembly (47, fig. 37) from pipe elbow (48).
- (3) Disassemble filter in accordance with steps (2) through (5) of paragraph b. above.
- (4) Disconnect top casting from pipe reducer (60).
- (5) Remove pipe elbow (48) from top casting.

d. Installation.

- (1) Install filter casting into pipe reducer (60, fig. 37).



- (2) Install pipe elbow (48) into top casting.
- (3) Assemble filter in accordance with steps (8) through (10) of paragraph b. above.

- (4) Connect fuel hose assembly (47) to pipe elbow (48).
- (5) Refer to paragraph 12 and install the power unit.

## Section XIV. FUEL TANK

### 94. General

The fuel tank is suspended within the base. Outlets are provided for the tube assemblies, and openings are provided for the fuel tank cap and for the fuel gage. A drain plug is provided in the rear of the tank.

### 95. Fuel Tank

#### a. Removal.

- (1) Refer to paragraph 12 and remove the power unit.
- (2) Remove drain plug (13, fig. 39) and drain fuel into a suitable container.

*Note.* Steps (3) through (5) below pertain only to the Model BT400-40 heater.

- (3) Disconnect filter-to-pump metal hose assembly (50, fig. 34) from fluid filter (47). Remove filter from pipe to tube tee (44).
- (4) Disconnect engine fuel hose assembly (59) from pipe elbow (43) and remove tee, elbow, reducer bushing (45), and pipe coupling (46), from fuel tank.
- (5) Disconnect pump-to-tank tube assembly (48) from straight adapter (34) and remove adapter from fuel tank. Disconnect block-to-tank tube assembly (33) from straight adapter (34) and remove adapter from tank.

*Note.* Steps (6) through (9) below pertain only to the Model BT400-40-1 heater.

- (5) Disconnect engine fuel metal hose assembly (50, fig. 37) from pipe-to-tube tee (44).
- (7) Disconnect fuel hose assembly (47) from pipe elbow (48) and remove tee, elbow, reducer bushing (45) and pipe coupling (46) from fuel tank.

- (8) Disconnect pump-to-tank tube assembly (49) from straight adapter (34) and remove connector from fuel tank. Disconnect block-to-tank tube assembly (33) from straight adapter (34) and remove connector from tank.
- (9) Remove three gaskets (35) from fuel tank.
- (10) Remove fuel tank cap (5, fig. 39) from tank, disengage retaining pin (8) from tank. Remove gasket (3).
- (11) Remove fuel gage (6) from tank.
- (12) Remove three screws (11), lockwashers (17) and nuts (18). Remove 20 cap screws (1 and 20) and lockwashers (2 and 19).
- (13) Lift heater from skid base (26) and set on supports to suspend fuel tank below heater.
- (14) Remove four screws (10) and lockwashers (9) and remove fuel tank (16). Remove four barrel nuts (15). Remove preformed packing (14) from tank.

#### c. Cleaning and Inspection.

- (1) Replace the drain plug and fill the tank one-half full with an approved cleaning solvent. Agitate the solvent, allow to settle for several minutes, inspect for leaks, then drain solution from tank. Run cleaning solvent through the tank until it comes out clean and clear.
- (2) Wash the exterior of the fuel tank and other metal parts with an approved cleaning solvent and dry thoroughly.
- (3) Inspect fuel tank for cracks, dents, damaged seams, and weak or rusted

spots. Inspect fuel gage parts for broken glass, deteriorated gaskets, inoperative float assembly and other damage. Replace damaged fuel gage.

*d. Installation.*

- (1) Install the machine thread plug (13, fig. 39) with preformed packing (14), in fuel tank. Install four barrel nuts (15).
- (2) Position fuel tank (16) below heater and secure with four screws (10) and lockwashers (9).
- (3) Lift heater, with attached tank, and position on skid base (26). Secure heater to base with 3 screws (11), lockwashers (17), and nuts (18) and 20 screws (1 and 20) and lockwashers (2 and 19).
- (4) Install fuel gage (6) in fuel tank.

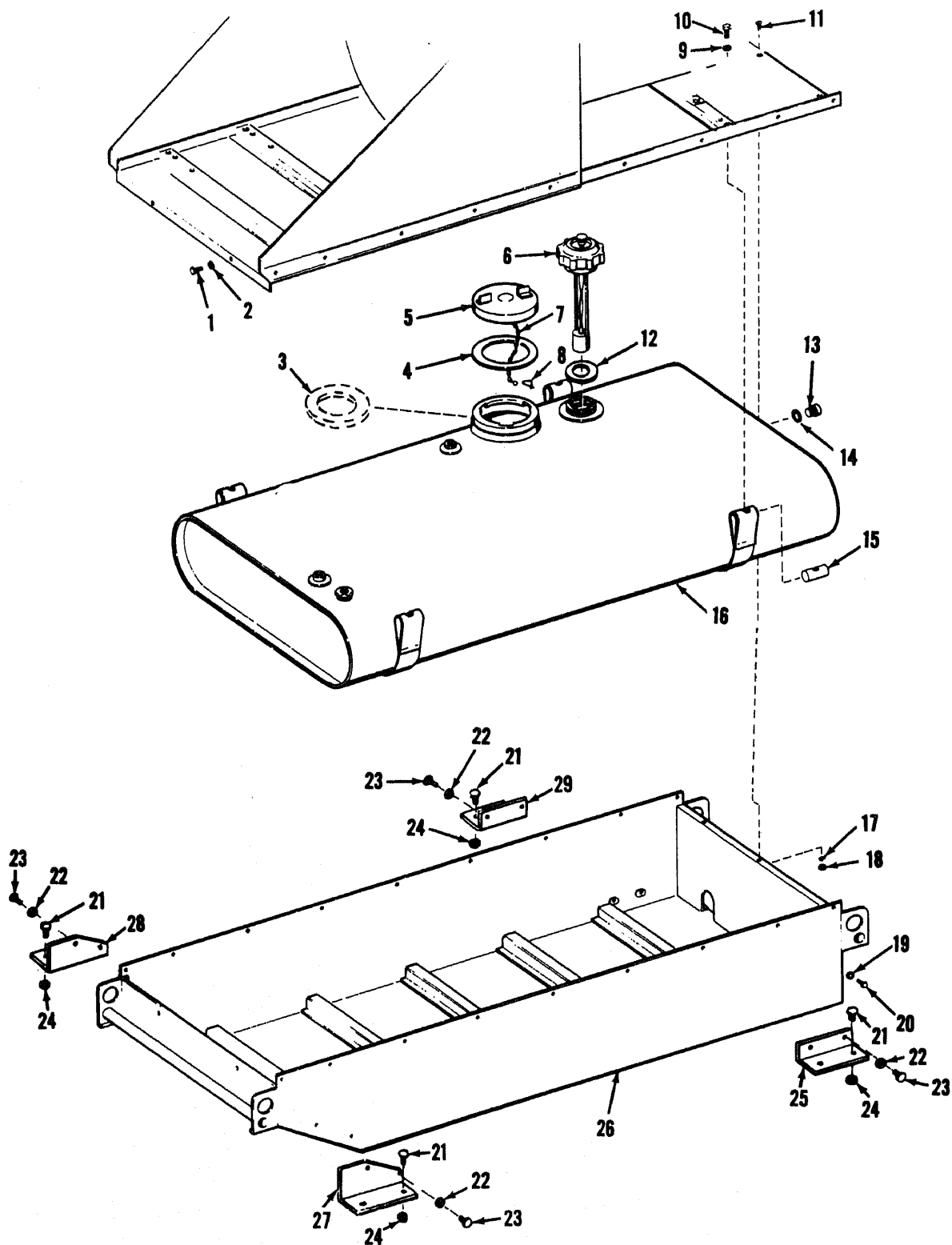
- (5) Install retaining pin (8) in tank and install gasket (3) and fuel tank cap (5).

*Note.* Step (6) below pertains only to the Model BT400-40 heater.

- (6) Install straight adapters (34, fig. 34), pipe coupling (46), and reducer bushing (45). Install pipe elbow (43) and pipe-to-tube tee (44) and connect tube assemblies. Install power unit (para 12).

*Note.* Step (7) below pertains only to the Model BT400-40-1 heater.

- (7) Install three gaskets (35, fig. 37), straight adapter (34), pipe coupling (46), and reducer bushing (45). Install pipe elbow (48) and pipe-to-tube tee (44) and connect tube assemblies. Install power unit (para 12).



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Figure 39. Fuel tank and base, exploded view.

- |  |   |
|--|---|
| 1 Screw, cap, hex hd, 1/4-20 x 1/2 in. (2)         | 16 Fuel tank (includes items 5 through 8)       |
| 2 Washer, lock IT, 1/4 in. (2)                     | 17 Washer, lock, No. 10 (8)                     |
| 3 Gasket   | 18 Nut, plain, hex, No. 10-24 (8)               |
| 4 Gasket   | 19 Washer, lock, IT, 1/4 in. (18)               |
| 5 Fuel tank cap                                    | 20 Screw, cap, hex hd, 1/4-20 x 1/2 in. (18)    |
| 6 Fuel gage  | 21 Screw, cap, hex hd, 1/4 x 20 x 1/2 in. (8)   |
| 7 Chain  | 22 Washer, lock, IT, 5/16 in. (8)               |
| 8 Retaining pin                                    | 23 Bolt, machine, hex hd, 5/16-18 x 1/2 in. (8) |
| 9 Washer, lock, IT, 3/8 in. (4)                    | 24 Nut, self-locking, 1/4-20 (8)                |
| 10 Screw, cap, hex hd, 3/8-16 x 2 in (4)           | 25 Left rear mounting bracket                   |
| 11 Screw, machine, pan hd, No. 10-24 x 3/8 in. (3) | 26 Skid base                                    |
| 12 Gasket  | 27 Left front mounting bracket                  |
| 13 Plug, machine thread                            | 28 Right front mounting bracket                 |
| 14 Performed packing                               | 29 Right rear mounting bracket                  |
| 15 Barrel nut (4)                                  |   |

Figure 39—Continued.

## Section XV. HEATER CONTROLS AND INSTRUMENTS

### 96. General

a. All controls and instruments necessary to operate the heater are incorporated in, or attached to, the fuel control box. The only exception is the damper control located on top of the casing at the discharge end of the heater. Controls for the power units are integral parts of the power units.

b. The controls are mounted on a block attached to the bulkhead. A sheet metal control box, with a hinged door, incloses the controls and protects them from damage and weather.

### 97. Heater Control Tube Assemblies (BT400-40)

a. *General.* Three tube assemblies lead to and from the controls. A bypass tube assembly carries bypass fuel from the fuel pump, through the coupling, to the bulkhead where it connects with the fuel control valve. A second tube assembly carries bypass fuel from the nozzle, through a check valve, to the temperature selector valve. Overflow fuel flows from the block through a tube assembly to the fuel tank.

#### b. Removal.

- (1) Remove cabinet and power unit (para 12). Remove two screws (1, fig. 34) and lockwashers (2); and two screws (4), lockwashers (67), and nuts (66) and remove control box (3) from fuel control.

- (2) Disconnect nozzle bypass-to-check valve tube assembly (31) from nozzle holder with tube assemblies (39). Remove flexible elbow (62) from tube assembly.
- (3) Disconnect nozzle bypass-to-check valve tube assembly (31) from pipe-to-tube elbow (30) at temperature selector valve. Remove two pipe elbows (30 and 27), pipe nipple (28), and check valve (29) from temperature selector valve. Remove tube assembly and grommet (63) from bulkhead.
- (4) Disconnect coupling-to-valve tube assembly (32) from coupling (56) and from pipe-to-tube elbow (30) at fuel control valve. Remove tube assembly and grommet (63) from bulkhead.
- (5) Disconnect block-to-tank tube assembly (33) from block and straight adapter (34) at fuel tank. Remove adapter from fuel tank and straight adapter (53) from block.

#### c. Cleaning and Inspection.

- (1) Clean all tube assemblies in an approved cleaning solvent and dry thoroughly.
- (2) Inspect tube assemblies for cracks, dents, bends, evidence of leaking, damaged threads, and other damage. Replace all damaged parts.

*d. Installation.*

- (1) Install pipe elbows (27 and 30, fig. 34) in valves. Install pipe nipple (28), check valve (29), and pipe-to-tube elbow (30) in temperature selector valve.
- (2) Install straight adapter (53) in block and straight adapter (34) in fuel tank.
- (3) Connect block-to-tank tube assembly (33) to block and fuel tank.
- (4) Position coupling-to-valve tube assembly (32) through bulkhead and grommet (63) and connect tube assembly to coupling (56) and pipe-to-tube elbow (30).
- (5) Position nozzle bypass-to-check valve tube assembly (31) through bulkhead and grommet (63). Install flexible elbow (62) on tube assembly and connect tube assembly to pipe-to-tube elbow (30) at temperature selector valve and to tube assembly from nozzle holder with tube assemblies (39).
- (6) Install control box (3) over fuel controls and secure with two screws (1), lockwashers (2), and two screws (4), lockwashers (67), and nuts (66).
- (7) Install power unit and cabinet (para 12).

**98. Heater Control Tube and Hose Assemblies (BT400-40-1)**

*a. General.* Two tube assemblies and one hose assembly lead to and from the heater controls. A bypass tube assembly carries bypass fuel from the fuel pump, through a coupling, to the bulkhead where it connects with the fuel control valve. A bypass hose assembly carries bypass fuel from the nozzle, through a check valve, to the temperature selector valve. Overflow fuel flows from the block through another tube assembly.

*b. Removal.*

- (1) Refer to paragraph 70 and remove the cabinet.
- (2) Refer to paragraph 77 and remove fan and mounting ring.
- (3) Remove two screws (1, fig. 37) and lockwashers (2); two screws (4), lockwashers (68), and nuts (67); and

remove control box (3) from fuel control.

- (4) Disconnect nozzle-to-check valve hose assembly (31) from pipe-to-tube elbow (30) at temperature selector valve. Remove two pipe elbows (27 and 30), pipe nipple (28), and check valve (29) from temperature selector valve. Remove hose assembly and grommet (63) from bulkhead.
- (5) Remove grommet (63) from casing and carefully pull hose assembly through hole in casing.
- (6) Disconnect nozzle-to-check valve hose assembly (31) from nozzle holder (40) and remove from heater.
- (7) Disconnect coupling-to-valve tube assembly (32) from coupling (61) and from pipe-to-tube elbow (30) at fuel control valve. Remove tube assembly and grommet (64) from bulkhead.
- (8) Disconnect block-to-tank tube assembly (33) from block and straight adapter (34) at fuel tank. Remove adapter from fuel tank and straight adapter (55) from block.

*c. Cleaning and Inspection.* Refer to paragraph 97c.

*d. Installation.*

- (1) Install pipe elbows (27 and 30, fig. 37) in valves. Install pipe nipple (28), check valve (29), and pipe-to-tube elbow (30) in temperature selector valve.
- (2) Install straight adapter (55) in block and straight adapter (34) in fuel tank.
- (3) Connect block-to-tank tube assembly (33) to block and fuel tank.
- (4) Position coupling-to-valve tube assembly (32) through bulkhead and grommet (64) and connect tube assembly to coupling (61) and pipe-to-tube elbow (30).
- (5) Position nozzle-to-check valve hose assembly (31) through casing and grommet (63) and connect hose assembly to nozzle holder (40).
- (6) Position nozzle-to-check valve hose assembly (31) through bulkhead and grommet (63) and connect to pipe-to-tube elbow (30).

- (7) Install control box (3) to fuel control using two screws (4), lockwashers (68), and nuts (67); and two screws (1) and lockwashers (2).
- (8) Refer to paragraph 77 and install the fan and mounting ring.
- (9) Refer to paragraph 70 and install cabinet and power unit.

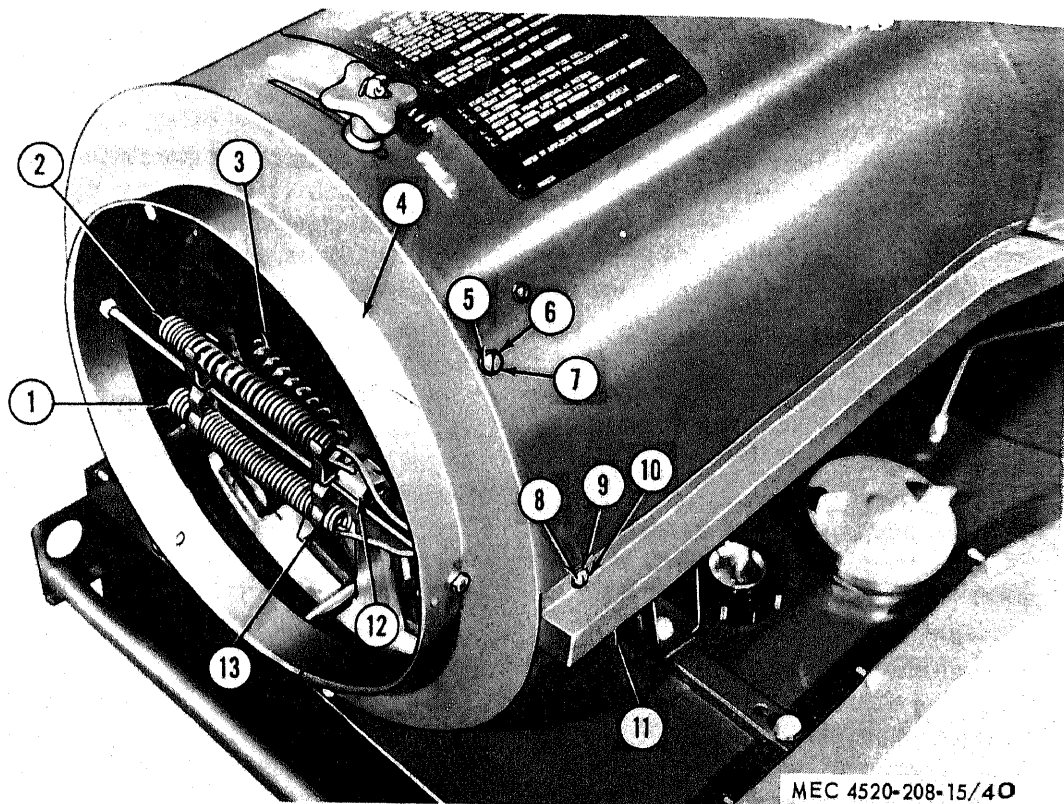
## 99. Discharge Temperature Gage

*a. General.* The discharge temperature gage indicates the temperature of the air being discharged from the outlet end of the heater in degrees Fahrenheit. A sensing element, mounted on the discharge end of the heater controls the temperature gage.

### b. Removal.

- (1) Remove control box from controls. Refer to paragraph 97 for BT400-40 and paragraph 98 for BT400-40-1.
- (2) Disengage sensing elements (1, 2, and 3, fig. 40) from clips (12 and 13).
- (3) Remove four screws (5), lockwashers (6) and nuts (7), and remove duct adapter assembly (4) from casing.
- (4) Remove three screws (8), lockwashers (9), and nuts (10), and remove capillary tube shield (11) from casing.
- (5) Withdraw temperature gage sensing element through hole in casing.

*Note.* Steps (6) through (8) below pertain only to the Model BT400-40 heater.



- |  |   |
|--|---|
| 1 Temperature selector valve sensing element | 8 Screw, machine, No. 10-24 x 3/8 in. (3) |
| 2 Fuel control valve sensing element         | 9 Washer, lock, IT, No. 10 (3)            |
| 3 Fuel temperature gage sensing element      | 10 Nut, plain, hex, No. 10-24 (3)         |
| 4 Duct adapter assembly                      | 11 Shield, capillary tube                 |
| 5 Screw, machine, No. 10-24 x 3/8 in. (4)    | 12 Clip, gage sensing element             |
| 6 Washer, lock, IT, No. 10 (4)               | 13 Clip, sensing element (2)              |
| 7 Nut, plain, hex, No. 10-24 (4)             |   |

Figure 40. Air discharge components, removal points.

- (6) Remove three setscrews (16, fig. 34) and remove temperature selector valve knob (19), temperature indicator knob (18), and fuel control valve knob (17).
- (7) Remove six screws (15) and (20), lockwashers (65 and 24), and nuts (66 and 25) and remove control panel (12) from controls and bulkhead.

*Note.* If necessary to gain clearance to withdraw sensing unit, remove two screws (38) and lockwashers (37). Disconnect tube assemblies (31 and 32) at pipe-to-tube elbows (30). Move block away from bulkhead and remove temperature gage with capillary tube and sensing element.

- (8) Remove temperature gage (22), with attached capillary tube and sensing element.

*Note.* Steps (9) through (10) below pertain only to the Model BT400-40-1 heater.

- (9) Remove three setscrews (16, fig. 37) and remove temperature selector valve knob (19), temperature indicator knob (18), and fuel control valve knob (17).
- (10) Remove six screws (15 and 20), lockwashers (66 and 24) and nuts (65 and 25) and remove control panel (12) from controls and bulkhead.

*Note.* If necessary to gain clearance to withdraw sensing unit, remove two screws (39) and lockwashers (38). Disconnect nozzle-to-check valve hose assembly (31) and coupling-to-valve tube assembly (32) at pipe-to-tube elbows (30). Move block away from bulkhead and remove temperature gage with capillary tube and sensing element.

#### c. Cleaning and Inspection.

- (1) Clean the temperature gage, tube, and sensing element with a cloth dampened in an approved cleaning solvent and dry thoroughly.
- (2) Inspect the temperature gage for broken glass, damage to tube and sensing element, or other damage. Replace entire unit if damaged.

#### d. Test Gage.

- (1) Insert sensing element of temperature gage into a container of oil along with a sensing element of a temperature gage known to be accurate.

- (2) Heat the oil and record the reading from both temperature gages. If the temperature gage removed from the heater has a reading different from accurate temperature gage, replace temperature gage.

#### e. Installation.

*Note.* Steps (1) through (3) pertain only to the Model BT400-40 heater.

- (1) Slide sensing element and capillary tube through bracket (23, fig. 34) and position temperature gage (22) on bracket.

*Note.* If tube assemblies (31 and 32) and block were disconnected, connect tube assemblies and secure block to bulkhead with two screw (38) and lockwashers (37).

- (2) Install control panel (12) on bracket and secure with six screws (15 and 20), lockwashers (65 and 24), and nuts (64 and 25) to bracket and bulkhead.
- (3) Position temperature selector valve knob (19) and fuel control valve and temperature indicator knobs (17 and 18) on control valves and secure with three setscrews (16).

*Note.* Steps (4) through (6) pertain only to the Model BT400-40-1 heater.

- (4) Slide sensing element and capillary tube through bracket (23, fig. 37) and position temperature gage (22) on bracket.

*Note.* If coupling-to-wave tube assembly (32), nozzle-to-check valve hose assembly (31), and block were disconnected, reconnect and secure block to bulkhead with two screws (39) and lockwashers (38).

- (5) Install control panel (12) on bracket and secure with six screws (15 and 20), lockwashers (66 and 24), and nuts (65 and 25) to bracket and bulkhead.
- (6) Position temperature selector valve knob (19) and fuel control valve and temperature indicator knobs (17 and 18) on control valves and secure with three setscrews (16).
- (7) Insert temperature gage sensing element (3, fig. 40) through hole in casing.

- (8) Install capillary tube shield (11) on casing and secure with three screws (8), lockwashers (9), and nuts (10).
- (9) Position duct adapter assembly (4) in casing and secure with four screws (5), lockwashers (6), and nuts (7).
- (10) Install sensing elements, (1 through 3) in clips (12 and 13) in duct adapter.
- (11) Install control box to fuel controls. Refer to paragraph 97 for BT400-40 and paragraph 98 for BT400-40-1.

## 100. Heater Control Valves and Block

*a. General.* The two heater control valves are secured to the fuel block and the block is mounted on the bulkhead. The fuel control valve turns the burner on and off and the temperature selector valve selects and regulates the discharge air temperature.

### *b. Removal.*

- (1) Remove heater control tube and hose assemblies. Refer to paragraph 97 for BT400-40 and paragraph 98 for BT400-40-1.
- (2) Remove temperature gage (para 99). Withdraw sensing elements (1 and 2, fig. 40) and capillary tubes from casing.

*Note.* Steps (3) and (4) below pertain only to the Model BT400-40 heater.

- (3) Remove temperature selector gear (11, fig. 34). Remove gland nut (21) from temperature selector valve and remove bracket (23) from valves.
- (4) Remove two screws (38) and lockwashers (37) and remove block, with attached valves, from heater.

*Note.* Steps (5) and (6) below pertain only to the Model BT400-40-1 heater.

- (5) Remove temperature selector gear (11, fig. 37). Remove gland nut (21) from temperature selector valve and remove bracket (23) from valves.
- (6) Remove two screws (39) and lockwashers (38) and remove block, with attached valves, from heater.

### *c. Cleaning and Inspection.*

- (1) Clean exterior of block and valves with an approved cleaning solvent and dry thoroughly.

- (2) Inspect valves and block for evidence of leaking and damage. Check capillary tubes and sensing elements for breaks, cracks, or other damage. Replace complete unit if damaged.

### *d. Installation.*

*Note.* Steps (1) and (2) below pertain only to the Model BT400-40 heater.

- (1) Position the block on bulkhead and secure with two screws (38, fig. 34) and lockwashers (37).
- (2) Position bracket (23) over valves. Install nut (21) on temperature selector valve. Install temperature selector gear (11) in bracket.

*Note.* Steps (3) and (4) below pertain only to the Model BT400-40-1 heaters.

- (3) Position the block on bulkhead and secure with two screws (39, fig. 37) and lockwashers (38).
- (4) Position bracket (23) over valve. Install temperature selector gear (11) in bracket.
- (5) Insert sensing elements (1 and 2, fig. 40) through casing. Install temperature gage (para 99).
- (6) Install heater control hose and tube assemblies. Refer to paragraph 97 for BT400-40 and paragraph 98 for BT400-40-1.

*e. Valve Test and Adjustment.* If the temperature selector valve is not coordinated with its knob, adjust valve as follows:

- (1) Test fuel pump pressure and adjust if necessary. Refer to paragraph 85 for BT400-40 or paragraph 90 for BT400-40-1.
- (2) Open the control box cover (fig. 11).
- (3) Turn temperature selector valve knob clockwise as far as it will go until the pointer on the temperature indicator knob is against the pin. If pointer does not travel far enough to reach pin, loosen setscrew securing knob and move pointer to pin and secure setscrew, provided temperature selector valve knob is at maximum clockwise position.



- (4) Attach a 12-inch flexible air hose to duct adapter at discharge end of heater. Make a small hole in the air hose approximately two feet from the adapter. Insert a thermometer in the hole, with a sensing element of the thermometer located at the center of the air hose. Anchor the thermometer in this position.
  - (5) Loosen the setscrew on temperature indicator knob. Turn temperature selector knob clockwise as far as it will go to close temperature selector valve.
  - (6) Turn the temperature selector valve knob counterclockwise three turns. Start the heater (para 32).
  - (7) When the reading on the discharge temperature gage (fig. 11) appears stable, allow heater to run five more minutes. Read thermometer in air hose. A reading of  $280^{\circ} \pm 10^{\circ}\text{F}$  is desired.
  - (8) If required temperature is not obtained, turn temperature selector valve knob one-quarter turn clockwise to increase temperature, or counterclockwise to decrease. Wait five minutes after temperature stabilizes, read the thermometer. Repeat one-quarter turns until desired range is obtained.
- Note.* The initial test setting of the temperature selector valve knob should be made to maintain a lower temperature, so that all subsequent adjustment will be made clockwise to prevent overheating.
- (9) When desired range is reached, check discharge temperature gage. If the

- temperature indicated is within  $10^{\circ}\text{F}$  plus or minus of the thermometer in the air hose, temperature gage may be considered accurate at high end of scale. If variation is greater than  $10^{\circ}\text{F}$ , note difference and take into account when operating heater.
- (10) After setting temperature selector valve to maintain the  $280^{\circ}\text{F}$ . range, set temperature selector indicator knob to the HIGH position with the pointer on the knob touching the pin. Tighten the setscrew to hold knob on shaft.
  - (11) Turn temperature selector valve knob counterclockwise to have temperature indicator knob pointer set at "1" on scale. After discharge air temperature appears to be stable, wait five minutes and read duct thermometer. A reading of  $150 \pm 10^{\circ}\text{F}$ . is desired.
  - (12) If reading is high, turn temperature selector valve knob counterclockwise until desired reading is obtained. This check is to determine if heater will operate at this low discharge temperature. If a lower temperature is obtained it is of little consequence.
  - (13) Check discharge temperature gage against temperature on air hose thermometer as in step (9) above.
  - (14) Recheck maximum temperature and adjust temperature selector valve indicator knob if necessary.
  - (15) Stop the heater (para 34).
  - (16) Remove thermometer from hole in air hose and patch inside of air hose using adhesive tape conforming to Specification PPP-T-60, Type III, Class I.

## Section XVI. TIME TOTALIZING METER (BT400-40)

### 101. General

The time totalizing meter is a direct-reading indicator, driven by a belt (preformed packing) from the magneto pulley. Mounted above the magneto, the time totalizing meter records the operating time of the heater in hours.

### 102. Time Totalizing Meter

a. *General.* The meter is mounted on a flange which is part of the mounting bracket.

b. *Removal.*

- (1) Remove the power unit (para 12).
- (2) Remove magneto pulley and time totalizing meter drive belt (para 82).

- (3) Remove four screws (3, fig. 29), lockwashers (10), and nuts (11) and remove time totalizing meter (4).
- (4) Drive spring pin (6) from pulley and shaft and remove meter groove pulley (5).

*c. Cleaning and Inspection.*

- (1) Clean all parts except drive belt, with a cloth dampened with an approved cleaning solvent and dry thoroughly.
- (2) Inspect time totalizing meter for cracked case, broken glass, damaged shaft, or other damage. Check belt

for stretching and wear. Inspect pulley for damage. Replace damaged parts.

*d. Installation.*

- (1) Position meter groove pulley (5, fig. 29) on time totalizing meter shaft and secure with spring pin (6).
- (2) Install time totalizing meter (4) on bracket and secure with four screws (3), lockwashers (10), and nuts (11).
- (3) Install meter drive belt (7) and magnet pulley (14) (par. 82).
- (4) Install power unit (para 12).

## Section XVII. ELECTRIC MOTOR POWER UNIT

### 103. General

*a.* The electric motor power unit is furnished as a part of the Model BT400-40 heater. The electric motor power unit requires a 208-220 volt, 3-phase, alternating current power supply.

*b.* The electric motor power unit may be used on the BT400-40-1 heater unit in the same manner as it is used on the BT400-40 heater. The electric motor unit is a basic issue item with the BT400-40 heater only.

### 104. Electric Motor Power Unit

*a. General.* The electric motor power unit and bracket mount on the same resilient mounts provided to support the gasoline engine power unit.

*b. Removal.*

- (1) Remove the electric motor power unit from the heater (para 12).
- (2) Remove four bolts (6, fig. 41), eight flat washers (7), and four self-locking nuts (13) and remove electric motor (1) from bracket (8).
- (3) Loosen three screws (2) and remove drive coupling (5) and tapered bushing (4) from motor shaft by tapping with a soft hammer or using a suitable puller. Remove screws (2) and lockwashers (3) and separate tapered bushing and drive coupling.

*c. Cleaning and Inspection.*

- (1) Clean all parts with and approved cleaning solvent and dry thoroughly.

- (2) Inspect electric motor for damage. Check drive coupling and tapered bushing for cracks or damage. Inspect bracket for cracks, bends, or other damage. Weld minor cracks and straighten bends. Replace all damaged parts.

*d. Installation.*

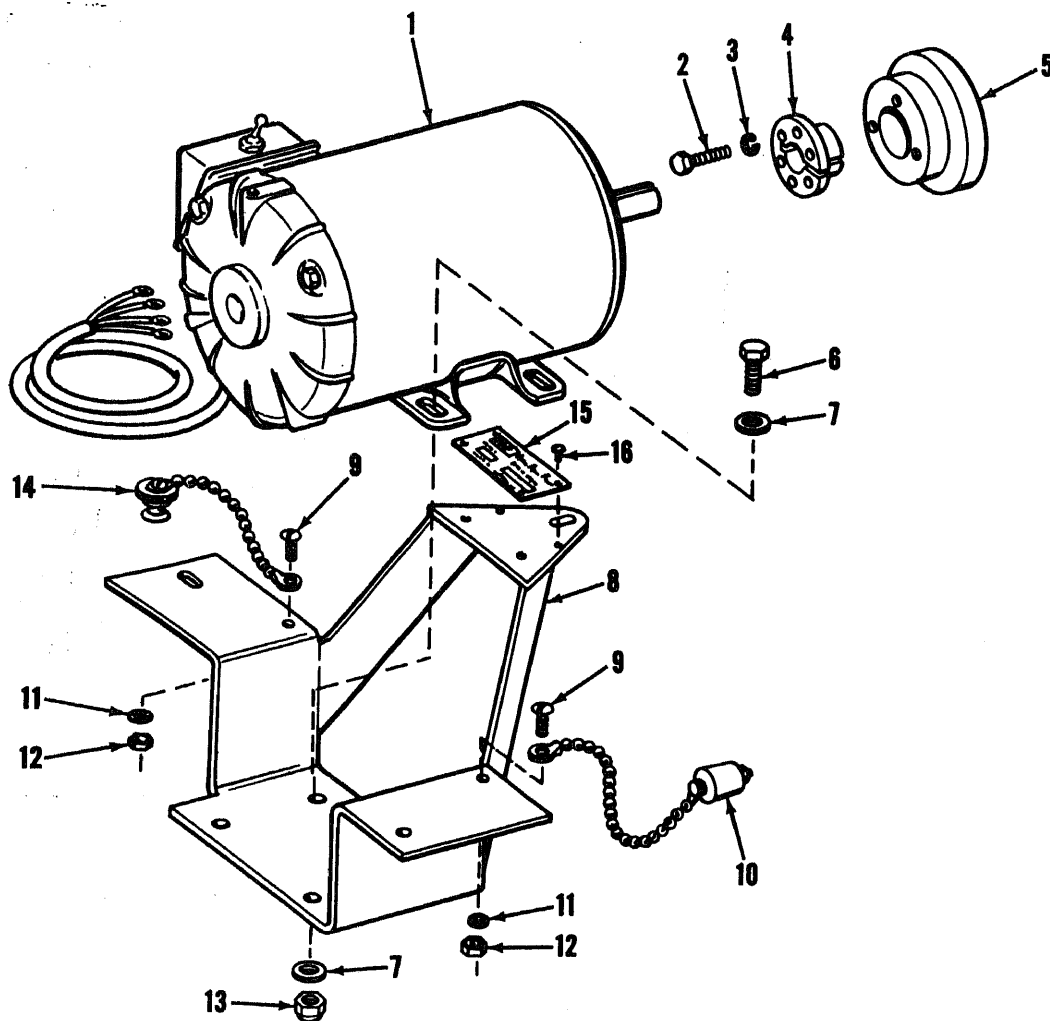
- (1) Install tapered bushing (4) on drive coupling (5) and install on motor shaft and secure with three screws (2) and lockwashers (3). Position tapered bushing and drive coupling on shaft and tighten screws to secure taper lock.
- (2) Install electric motor (1) on bracket (8) and install four bolts (6), eight flat washers (7), and self-locking nuts (13).
- (3) Install electric motor power unit (para 12). If necessary, adjust electric motor power unit forward or to the rear in slots on bracket to assure drive coupling mating with flexible rubber sleeve on fan shaft bearing.

### 105. On-Off Switch

*a. General.* The toggle switch is mounted on the side of the cover.

*b. Removal.*

- (1) Remove cabinet (para 12).
- (2) Remove two screws (5, fig. 42) and lift cover (4) away from junction box.



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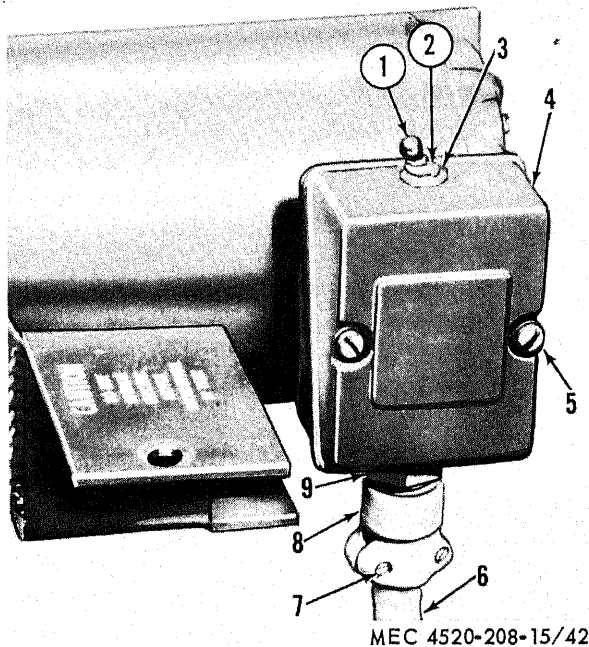
- |   |   |
|---|---|
| 1 Electric motor                            | 9 Screw, machine, No. 10-24 x 3/8 in. (2) |
| 2 Screw, cap, hex hd, No. 10-24 x 1 in. (8) | 10 Engine exhaust plug                    |
| 3 Washer, lock, No. 10 (3)                  | 11 Washer, lock, IT, No. 10 (2)           |
| 4 Tapered bushing                           | 12 Nut, plain, hex, No. 10-24 (2)         |
| 5 Drive coupling                            | 13 Nut, self-locking, 5/16-18 (4)         |
| 6 Bolt, machine, hex hd, 5/16-18 (4)        | 14 Dust plug                              |
| 7 Washer, flat, 5/16 in (8)                 | 15 Identification plate, power unit       |
| 8 Bracket                                   | 16 Rivet (4)                              |

Figure 41. Electric motor power unit.

- (3) Tag and disconnect seven leads (1, fig. 43) from terminal block at rear of ON-OFF switch (2).
- (4) Remove boot (2, fig. 42) and switch nut (3) and remove ON-OFF switch. Remove gasket (3, fig. 43) from cover (4).

c. *Cleaning and Inspection.*

- (1) Clean ON-OFF switch and cover with a cloth dampened in an approved cleaning solvent and dry thoroughly.
- (2) Inspect ON-OFF switch and cover for breaks, cracks, bends, damaged threads, missing terminals or hard-



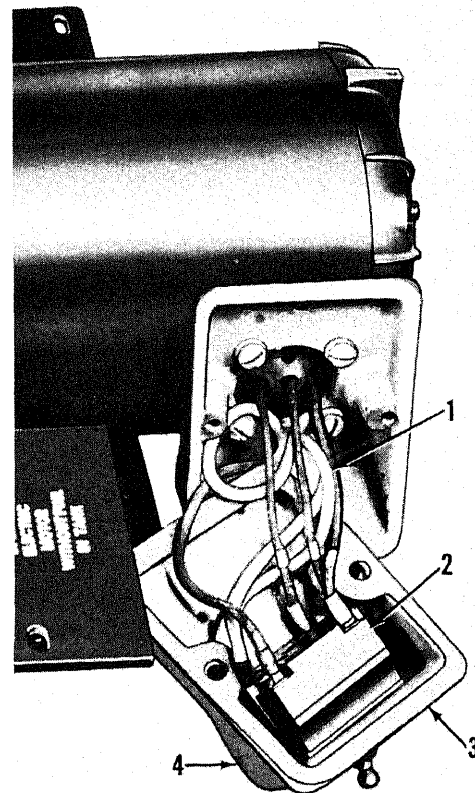
- 1 ON-OFF switch
- 2 Boot
- 3 Switch nut
- 4 Cover
- 5 Screw (2)
- 6 Cable
- 7 Screw (2)
- 8 Body
- 9 Nut

Figure 42. ON-OFF switch and cable, removal points.

ware, improper operation, or other damage. Replace defective ON-OFF switch. Replace damaged cover or gasket.

*d. Installation.*

- (1) Position gasket (3, fig. 43) in cover (4). Position ON-OFF switch in cover and secure with switch nut (3, fig. 42). Install boot (2).
- (2) Connect the tagged leads (1, fig. 43) to terminal block at rear of ON-OFF switch (2).
- (3) Position cover, with attached switch, on junction box and secure with two screws (5, fig. 42).
- (4) Install cabinet (para 12).



- 1 Lead (7)
- 2 ON-OFF switch
- 3 Gasket
- 4 Cover

Figure 43. ON-OFF switch, removal points.

## 106. Cable and Connector

*a. General.* The 4-conductor cable is connected to the terminal block at the rear of the ON-OFF switch. A cable connector attaches the cable to the junction box cover.

*b. Removal.*

- (1) Refer to paragraph 12 and remove electric motor power unit.
- (2) Refer to paragraph 105 and remove junction box cover and disconnect cable leads from ON-OFF switch.

- (3) Remove nut (9, fig. 42) from junction box cover and remove cable (6), with attached connector, from junction box cover.
- (4) Loosen two screws (7) securing cable to connector body (8) and remove cable.
- (5) Remove nut (9) from connector body and remove gland washer and rubber bushing from nut (9).

*c. Cleaning and Inspection.*

- (1) Wipe the cable clean with a cloth dampened with soap and water and dry thoroughly. Clean metal parts in an approved cleaning solvent and dry thoroughly.
- (2) Inspect the cable for cuts, breaks, sharp kinks, deterioration, missing ter-

minals, or other damage. Inspect connector for defects. Replace all damaged parts.

*d. Installation.*

- (1) Position rubber bushing and gland washer in nut (9, fig. 42) and install nut on connector body (8).
- (2) Insert cable (6) into the connector and secure by tightening two screws (7).
- (3) Install cable, with attached connector, on cover (4) and secure with nut (9).
- (4) Refer to paragraph 105 and connect cable leads to ON-OFF switch and install ON-OFF switch and cover on junction box.
- (5) Refer to paragraph 12 and install electric motor power unit.

## Section XVIII. TRAILER COMPONENTS

### 107. General

a. The tubular framed trailer is designed to transport the heater. An adjustable tow bar is mounted on the front of the frame to be used in towing the trailer.

b. A basket mounted on the front of the heater carries the 12-inch air hose and duct adapter. Duct holds on the sides support and store the 6-inch air hose when not in use.

### 108. Trailer Wheels

a. *General.* The two trailer wheels are mounted on the axle and are the pneumatic-tire type. The wheels are free running, with no driving or braking components attached.

*b. Removal.*

- (1) Remove wheel bearings (para 42).
- (2) Remove five nuts (11, fig. 44) and lockwashers (10) securing the wheel to hub assembly (2) and remove wheel and tire.
- (3) Remove outer and inner tapered roller bearing cups (3 and 13) and plain encased seal (14) from the hub assembly (2).

*c. Disassembly.*

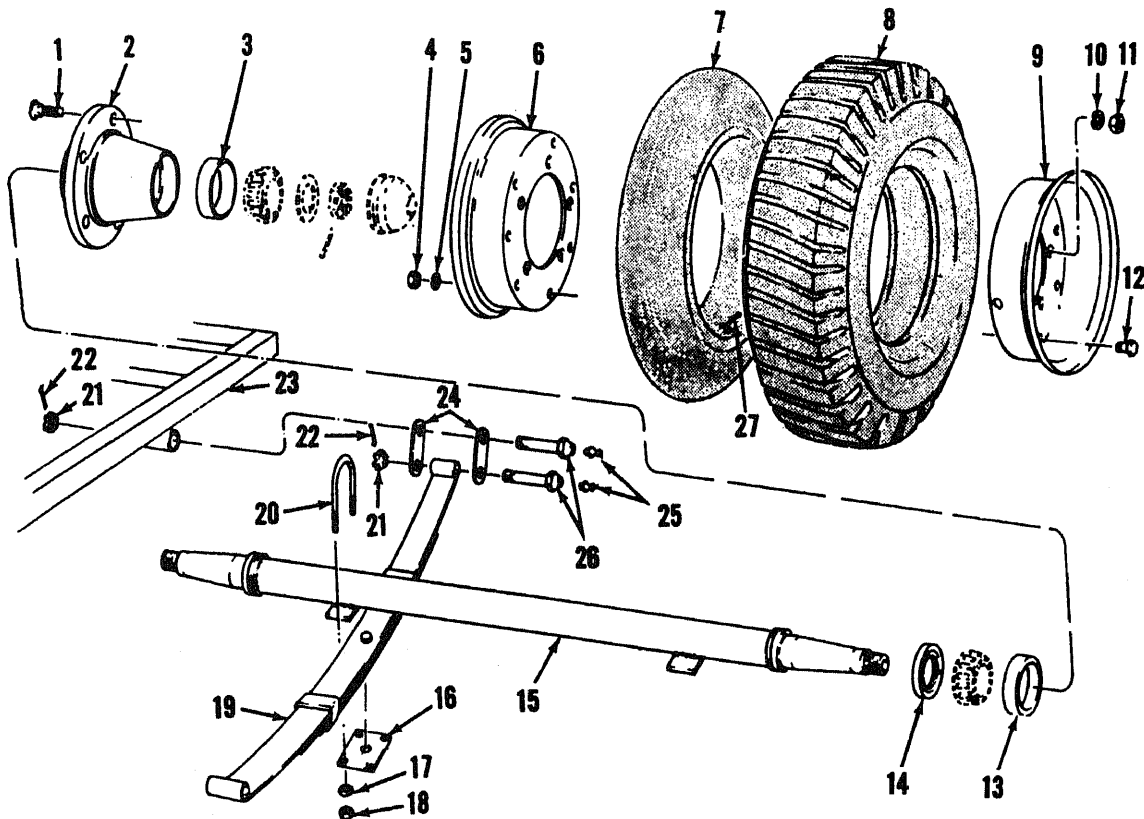
- (1) Remove valve cap and valve core (27) from valve stem and allow air to escape from inner tube (7).

- (2) Remove eight rim bolts (12), lockwashers (5), and nuts (4) that secure outer rim (9) to inner rim (6). Separate outer and inner rims and remove from pneumatic tire (8) and inner tube (7). Remove inner tube from pneumatic tire.

- (3) Remove ribbed shoulder bolts (1) from hub assembly. Remove and disassemble the other wheel in the same manner.

*d. Cleaning, Inspection, and Repair.*

- (1) Clean the tire and tube with mild soap and water and dry thoroughly. Remove rust and scale from wheel assembly with a wire brush.
- (2) Clean all metal parts in an approved cleaning solvent and dry thoroughly.
- (3) Install valve cores and inflate the tubes and submerge in water. Check for air bubbles which will indicate a leak in the tube. Repair the tube if it is leaking.
- (4) Inspect the tires for wear, holes, cuts, broken cords, deterioration, or other damage. Replace a worn or damaged tire.
- (5) Inspect all metal parts for cracks, breaks, wear, damaged threads, corrosion, distortion, or other damage.



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- |   |                                     |
|---|-------------------------------------|
| 1 Bolt, ribbed, shoulder, 1/2-20 x 1 7/8 in. (10) | 15 Axle assembly                    |
| 2 Hub assembly (2)                                | 16 Plate (2)                        |
| 3 Outer tapered roller bearing cup                | 17 Washer, lock, 1/4 in. (8)        |
| 4 Nut, plain, hex, 3/8 - 24 (16)                  | 18 Nut, plain, hex, 1/4-20 (8)      |
| 5 Washer, lock, 3/8 in. (16)                      | 19 Spring assembly (2)              |
| 6 Inner rim (2)                                   | 20 U bolt, 1/4-2 (4)                |
| 7 Inner tube, pneumatic (2)                       | 21 Nut, slotted, hex, 9/16-18 (6)   |
| 8 Pneumatic tire (2)                              | 22 Pin, cotter, 1/8 x 1 1/2 in. (6) |
| 9 Outer rim (2)                                   | 23 Trailer frame assembly           |
| 10 Washer, lock, 1/2 in. (10)                     | 24 Shackle (4)                      |
| 11 Nut, plain, hex, 1/2-20 (10)                   | 25 Lubrication fitting (6)          |
| 12 Bolt, rim, 3/8-24 x 3/4 in. (16)               | 26 Bolt, shackle (6)                |
| 13 Inner tapered roller bearing cup               | 27 Valve core                       |
| 14 Seal, plain, encased (2) (7, fig. 18)          |                                     |

Figure 44. Wheel, axle, and spring assemblies, exploded view.

Inspect the rollers in the bearing cones for looseness or discoloration due to overheating. Inspect the outer and inner bearing cups for pits, grooves, and discoloration due to overheating. The bearings and cups must have a bright, smooth metallic finish.

(6) Replace the seal and all damaged parts.

*e. Reassembly.*

- (1) Install valve core (27) in valve stem.
- (2) Install five ribbed shoulder bolts (1) in hub assembly (2).
- (3) Install inner tube (7) in pneumatic tire (8) and partially inflate the tube.

- (4) Position inner and outer rims on tire and tube, insert valve stem through hole in rim with hole (9), and secure by installing eight rim bolts (12), lockwashers (5), and nuts (4).

*f. Installation.*

- (1) Install outer and inner tapered roller bearing cups (3 and 13).
- (2) Position assembled wheel on hut assembly and secure by installing five nuts (11) and lockwashers (10).
- (3) Install wheel bearings and seal (para 42).
- (4) Inflate tires to normal pressure, 20 psi.

**Warning:** When inflating trailer tires, remain to one side of tire rather than directly in front of it. Serious injury may result if tube blows out.

- (5) Install valve cap.

## 109. Axle

*a. General.* The axle, on which the wheels are mounted, is of the stationary type. The axle is secured to the leaf springs with U-bolts.

*b. Removal.*

- (1) Remove trailer wheels and wheel bearings (para 42).
- (2) Remove four nuts (18, fig. 44) and lockwashers (17) securing axle assembly (15) to spring assembly (19) and remove two U-bolts (20) and spring mounting plate (16). Remove two U-bolts from the other spring in the same manner and remove the axle assembly from the spring.

*c. Cleaning, Inspection, and Repair.*

- (1) Clean all parts in and approved cleaning solvent and dry thoroughly.
- (2) Inspect all parts for breaks, cracks, bends, burs, damaged threads, or other damage.
- (3) Remove all burs from the spindle end of the axle.
- (4) Weld small breaks and cracks or replace a damaged axle.

*d. Installation.*

- (1) Position the axle assembly (15) on the spring assemblies (19) and secure by installing the four U-bolts (20), two plates (16), eight lockwashers (17), and eight nuts (18).
- (2) Install trailer wheels and wheel bearings (para 42).

## 110. Springs

*a. General.* The trailer is equipped with leaf springs to absorb road shock while transporting heater.

*b. Removal.*

- (1) Remove the axle (para 109).
- (2) Remove two cotter pins (22, fig. 44), slotted hex nuts (21), and shackle bolts (26) securing two shackles (24) to trailer frame assembly (23) and spring assembly (19). Remove the shackles from the frame and the spring.
- (3) Remove cotter pin (22), slotted hex nut (21), and shackle bolt (26) securing other end of spring assembly (19) to trailer frame assembly (23) and remove spring.
- (4) Remove three lubrication fittings (25) from shackle bolts (26). Remove the other spring in the same manner.

*c. Cleaning and Inspection.*

- (1) Clean all parts in an approved cleaning solvent and dry thoroughly.
- (2) Inspect all parts for breaks, cracks, bends, weakened condition, or other damage.
- (3) Replace all damaged or missing parts.

*d. Installation.*

- (1) Install three lubrication fittings (25) on shackle bolts (26).
- (2) Position two shackles (24) on trailer frame assembly (23) and secure by installing shackle bolt (26), slotted hex nut (21), and cotter pin (22). Secure spring to shackles and trailer frame assembly in the same manner. Install the other spring in the same manner.
- (3) Install the axle (para 109).

### 111. Tow Bar and Pins

*a. General.* An adjustable tow bar is mounted on the front of the trailer frame. Tow bar can be attached to the pintle of a towing vehicle or to another trailer. Each trailer has a pin assembly on the rear of the trailer frame for securing the tow bar of another trailer. The tow bar can be lowered to a vertical position to form a support to keep the trailer in a level position.

#### *b. Removal.*

- (1) Support front end of trailer frame to keep it level.
- (2) Remove tow bar assembly (13, fig. 45) from tow bar assembly (22) and trailer frame assembly (21).
- (3) Remove screw (23) and self-locking nut (7) securing tow bar to trailer frame and remove tow bar.
- (4) Remove screw (12) and lockwasher (11) securing chain and tow bar pin assembly to the trailer frame and remove the pin.
- (5) Remove pintle pin assembly (18) in the same manner.

#### *c. Cleaning and Inspection.*

- (1) Clean all parts in an approved cleaning solvent and dry thoroughly.
- (2) Inspect all parts for breaks, cracks, bends, broken links, damaged threads, or other damage. Replace all unserviceable damaged parts.

#### *d. Installation.*

- (1) Install two chains connected to pin assemblies (13 and 18) on trailer frame assembly (21) and secure with two screws (12) and lockwashers (11).
- (2) Position tow bar assembly (22) on trailer frame and secure by installing screw (23) and self-locking nut (7).
- (3) Secure tow bar assembly (22) in the desired position by installing tow bar pin assembly (13).
- (4) Remove blocking (b(1) above).

### 112. Basket

*a. General.* The basket, mounted to the handle, affords storage for the 12-inch air hose and duct adapter.

*b. Removal.* Remove four U-bolts (2, fig. 45), lockwashers (5), and nuts (4) that secure basket (1) to handle and remove basket.

#### *c. Cleaning Inspection, and Repair.*

- (1) Clean all parts in an approved cleaning solvent and dry thoroughly.
- (2) Inspect the basket and hardware for breaks, cracks, bends, damaged threads, or other damage. Straighten minor bends, weld all breaks and cracks, and replace damaged hardware. Replace the basket if it is unserviceable.

*d. Installation.* Position basket (1, fig. 45) on handle and secure by installing four U-bolts (2), lockwashers (5), and nuts (4).

### 113. Duct Holders

*a. General.* The 6-inch air hose, when not in use, are stored on the duct holders.

#### *b. Removal.*

- (1) Remove screw (10, fig. 45), lockwasher (9), and nut (8) that secure duct holder (14) to trailer frame and remove duct holder.
- (2) Remove remaining two duct holders (14) in the same manner.

#### *c. Cleaning and Inspection.*

- (1) Clean all parts in an approved cleaning solvent and dry thoroughly.
- (2) Inspect all parts for breaks, bends, cracks, damaged threads, missing parts, or other damage. Replace all missing or damaged parts.

#### *d. Installation.*

- (1) Position duct holder (14, fig. 45) on trailer frame assembly (21) and secure by installing screw (10), lockwasher (9), and nut (8).
- (2) Install remaining two duct holders (14) in the same manner.

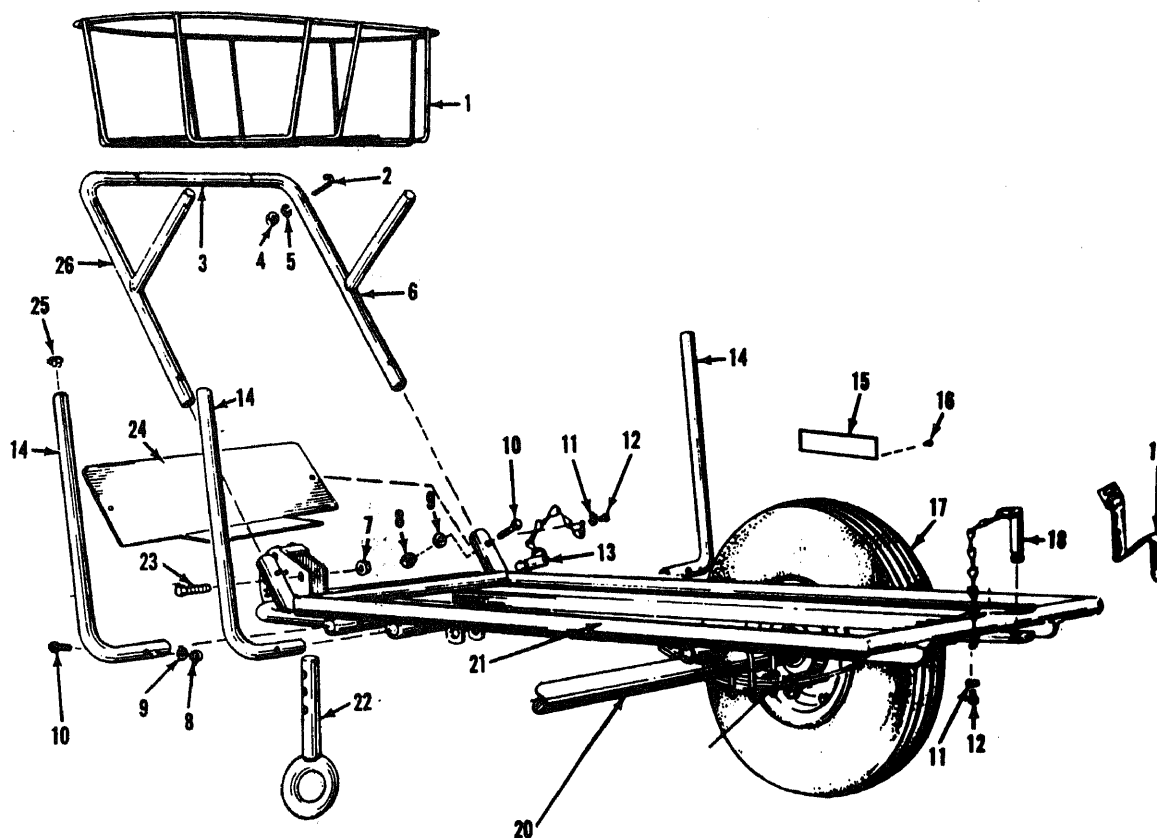
### 114. Handle

*a. General.* The handle, mounted on the front of the trailer frame, affords the operator ease of movement when manually moving the heater about.

#### *b. Removal.*

- (1) Remove the basket (para 112).





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- |   |   |
|---|---|
| 1 Basket                                      | 14 Duct holder (3)                        |
| 2 Bolt, U (4)                                 | 15 Identification plate                   |
| 3 Handle, horizontal                          | 16 Rivet, solid (4)                       |
| 4 Nut, plain, hex, No. 10-24 (4)              | 17 Wheel and tire assembly (fig. 18)      |
| 5 Washer, lock, No. 10 (4)                    | 18 Pin assembly, pintle                   |
| 6 Handle, right side                          | 19 Strap (4)                              |
| 7 Nut, self-locking, hex, 1/2-20              | 20 Axle assembly (fig. 45)                |
| 8 Nut, self-locking, hex, 1/4-20 (5)          | 21 Frame assembly                         |
| 9 Washer, flat, 1/4 in. (5)                   | 22 Tow bar assembly                       |
| 10 Screw, cap, hex hd, 1/4-20 x 1 3/4 in. (5) | 23 Screw, cap, hex hd, 1/2-20 x 2 1/2 in. |
| 11 Washer, lock, 1/4 in. (2)                  | 24 Snow shield                            |
| 12 Screw, machine, 1/4-20 x 5/16 in. (2)      | 25 Button plug (5)                        |
| 13 Pin assembly, tow bar                      | 26 Handle, left side                      |

Figure 45. Trailer assembly, exploded view.

- (2) Remove two screws (10, fig. 45), lockwashers (9), and nuts (8) that secure handle and snow shield (24) to trailer frame and remove handles (3, 6, and 26) and snow shield.

*c. Cleaning, Inspection, and Repair.*

- (1) Clean all parts in an approved cleaning solvent and dry thoroughly.

- (2) Inspect all parts for breaks, cracks, bends, damaged threads or other damage. Weld small breaks and cracks, straighten minor bends, or replace all damaged or missing parts.

*d. Installation.*

- (1) Place side handles (6 and 26) on horizontal handle (3). Position assembled handle and snow shield (24)

on trailer frame and secure by installing two screws (10), lockwashers (9) and nuts (8).

- (2) Install the basket (para 112).

### 115. Trailer Frame

*a. General.* The trailer frame, of welded, tubular steel construction, affords ease of transportation for the heater.

#### *b. Removal.*

- (1) Remove the handle (para 114).
- (2) Remove the duct holders (para 113).

*Note.* Step (3) below, pertains only to Model BT400-40 heaters.

- (3) Remove four straps (19, fig. 45) and lift heater from trailer frame assembly (21).

*Note.* Steps (4) and (5) below pertain only to Model BT400-40-1 heaters.

- (4) Remove four straps (19).
- (5) Remove eight screws (21, fig. 39) and self-locking nuts (24) securing skid base (26) to trailer frame assembly (21, fig. 46) and lift heater from trailer frame.

- (6) Remove the tow bar and pin (para 111).

- (7) Remove the springs (para 110).

#### *c. Cleaning, Inspection, and Repair.*

- (1) Clean the trailer frame with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the trailer frame for breaks, cracks, bends, broken welds, or other damage. Weld all breaks, cracks, or broken welds. Replace the trailer frame if unserviceable.

#### *d. Installation.*

- (1) Install the springs (para 110).
- (2) Install the tow bar and pin (para 111).

- (3) Position the heater on the trailer frame (para 11).

*Note.* Step (4) below pertains only to Model BT400-40-1 heaters.

- (4) Secure skid base (26, fig. 39) by installing eight screws (21) and self-locking nuts (24).
- (5) Install four straps (19, fig. 45) to secure heater to trailer frame.
- (6) Install the duct holders (para 113).
- (7) Install the handle (para 114).

## CHAPTER 4

### DEMOLITION, SHIPMENT, AND LIMITED STORAGE

#### Section I. DEMOLITION OF HEATER TO PREVENT ENEMY USE

##### 116. General

When capture or abandonment of the heater to an enemy is imminent, the responsible unit commander must make the decision either to destroy the heater or to render it inoperative. Based on this decision, orders are issued which cover the desired extent of destruction. Whatever method of demolition is employed, it is essential to destroy the same vital parts of all heaters and all corresponding repair parts.

##### 117. Demolition to Render the Heater Inoperative

###### *a. Misuse.*

- (1) Remove the three heat sensing elements from the discharge end of the heater and sever from the capillary tubes.
- (2) Set the temperature selector indicator knob to the HIGH position.
- (3) Remove the governor linkage from the carburetor.
- (4) Start the heater and allow to run at ungoverned speed until the heater fails.

**Warning:** This method may eventually cause the fuel tank to explode. Keep at a safe distance after starting the heater.

###### *b. Mechanical Means.*

- (1) Puncture the heat exchanger, fuel tank, and tires with a pickax.
- (2) Use a sledge hammer, pickax, or any other heavy tool available to destroy the heat exchanger, fuel atomizing nozzle, fuel pump, magneto, fuel control, and both power units.

##### 118. Demolition by Explosives or Weapons' Fire

*a. Explosives.* Refer to figure 46 and place as many of the following charges as the situation permits, and detonate them simultaneously with detonating cord and a suitable detonator:

- (1) One 1/2-pound charge on each wheel.
- (2) One 1/2-pound charge inside the exhaust stack.
- (3) One 1/2-pound charge under the power unit.

*b. Weapons' Fire.* Fire on the heater with the heaviest weapons available.

##### 119. Other Demolition Methods

*a. Scattering and Concealment.* Remove all easily accessible vital parts, such as the fuel pump, magneto, fuel atomizing nozzle, igniter plug, and sensing elements. Remove the carburetor, spark plug, and starter from the gasoline engine power unit. Remove the cooling fan, rotor, and cable from the electric motor power unit. Scatter them through dense foliage, bury them, or throw them in a body of water.

*b. Burning.* Puncture the top of the fuel tank. Pack rags, clothing, or canvas around the interior of the cabinet. Saturate with gasoline, oil, or diesel fuel and ignite.

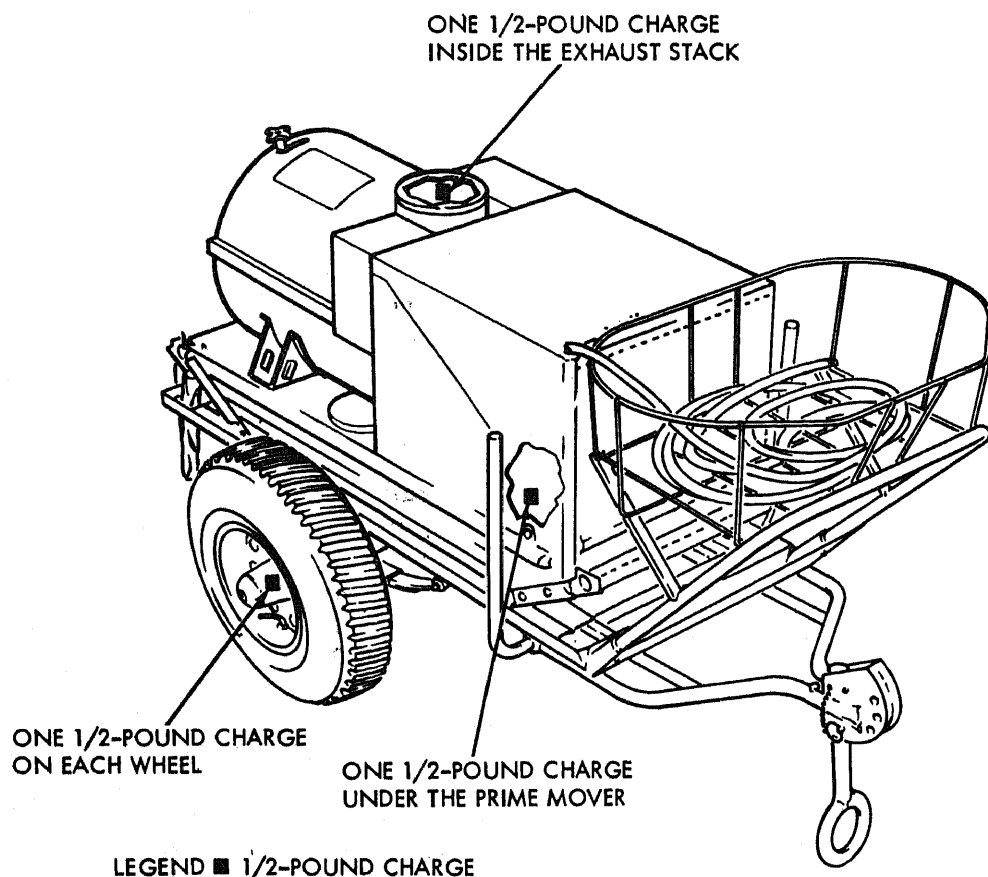
*c. Submersion.* Totally submerge the heater in a body of water to provide some water damage and concealment. Salt water will do the greatest damage to metal parts.

##### 120. Training

All operators should receive thorough training in the destruction of the heater. Refer to FM 5-25. Simulated destruction, using all of

the methods listed above, should be included in the operator training program. It must be emphasized in training, that demolition operations are usually necessitated by critical situations when time available for destruction is

limited. For this reason, it is necessary that operators be thoroughly familiar with all methods of destruction and be able to carry out demolition instructions without reference to this or any other manual.



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Figure 46. Placement of charges.

## Section II. SHIPMENT AND LIMITED STORAGE

### 121. Preparation of Equipment For Shipment

*a. General.* Detailed instructions for the preparation of the heater for domestic shipment are outlined within this paragraph. Preservation will be accomplished in a sequence that will not require the operation of previously preserved components.

*b. Inspection.* The heater will be inspected for any unusual conditions such as damage, rusting, accumulation of water, and pilferage. Inspection of individual components and assemblies will be as outlined on the "Preventive Maintenance Service, Quarterly" in this manual.

*c. Cleaning and Drying.* All contamination shall be removed from the heater by an approved method. Approved methods of cleaning,

drying, type of preservatives, and methods of application are described in TM 38-230.

*d. Painting.* Paint all surfaces where the paint has been removed or damaged. Refer to TB ENG 60 for detailed cleaning and painting instructions.

*e. DA Form 2258 (Depreservation Guide of Engineer Equipment).*

- (1) A properly annotated depreservation guide will be completed concurrently with preservation for each heater. Any peculiar requirements will be outlined in the blank spaces on the form. The completed depreservation guide will be placed with the heater in a waterproof envelope marked "Depreservation Guide," and fastened in a conspicuous location on or near the operator's controls.
- (2) Prior to placing equipment in operation or to the extent necessary for inspection, depreservation of the item shall be performed as outlined on the depreservation guide.

*f. Sealing of Openings.* Openings that will permit the direct entry of water into the interior of gasoline engine power unit, electric motor, motor junction box, exhaust stack, and control panel and air inlet doors shall be sealed with pressure sensitive tape conforming to Specification PPP-T-60. Type III, Class I. Refer to TM 5-2805-208-14 for instructions on preparation for shipment of the gasoline engine.

*g. Fuel Tank.* Drain the fuel tank after engine preservation and fog interior with preservative oil conforming to Specification MIL-L-21260.

*h. Exterior Surfaces.* Coat exposed machined ferrous metal surfaces with preservation conforming to Specification MIL-C-11796, Class III. If preservative is not available cup grease may be used.

*i. Marking.* Markings shall conform to MIL-STD-129.

*j. Disassembly, Disassembled Parts, and Basic Issue Items.*

- (1) Provide a box of sufficient size to pack the power unit not installed on the heater and the items listed on the Basic Issue Items list is Appendix III.
- (2) Refer to TM 38-230 for additional packing information to provide adequate protection against damage during shipment.

## 122. Loading Equipment for Shipment

*a.* Use appropriate materials handling equipment of sufficient capacity to lift the heater on the carrier. Load the wooden box on the carrier.

*b.* Secure the heater and wooden box to the carrier with blocking and metal straps to prevent movement during transit.

*c.* Cover the heater and box with a waterproof covering.

## 123. Preparation of Equipment for Storage

*a. General.* Detailed instructions for preparation of the heater for limited storage are detailed in paragraph 121. Limited storage is defined as storage not to exceed six (6) months. Refer to AR 743-505.

*b. Storage Site.* Every effort should be made to provide covered storage for the heater. If this is possible, select a firm, level, well drained storage location, protected from prevailing winds. Position the heater on heavy planking. Cover the heater with a tarpaulin or other suitable waterproof covering and secure in a manner that will provide the heater maximum protection from the elements.

## 124. Inspection and Maintenance of Equipment in Storage

Every ninety (90) days the heaters in storage will be inspected as outlined on the "Preventive Maintenance Services, Quarterly" and operated long enough to assure complete lubrication of all bearings. After each inspection period the heater shall be represerved as outlined in paragraph 121.

## CHAPTER 5

### DIRECT AND GENERAL SUPPORT AND DEPOT MAINTENANCE INSTRUCTIONS

---

#### Section I. GENERAL

##### 125. Scope

These instructions are published for the use of direct support, general support, and depot maintenance personnel maintaining the B400-40 and BT400-40-1 heaters. They provide maintenance of the equipment which is beyond the scope of tools, equipment, personnel, or

supplied normally available to using organization.

##### 126. Record and Report Forms

For the record and report forms applicable to direct support, general support, and depot maintenance, refer to TM 38-750.

*Note.* Applicable forms shall be kept in a canvas case mounted on the equipment.

#### Section II. DESCRIPTION AND DATA

##### 127. Description

A general description of the heater and the location and description of the identification and instruction plates are contained in paragraph 3 and 4 of this manual. The repair and maintenance instructions are described in appropriate sections of this manual.

overhaul data pertinent to direct and general support and depot maintenance personnel.

*b. Engine Repair and Replacement Standards.* Refer to TM 5-2805-208-14 for repair and replacement standards for the Model 1A08-III Military Standard Engine provided with the heater.

##### 128. Tabulated Data

*a. General.* This paragraph contains all the

*c. Nozzle.*

Fuel flow ----- 3.825 gph max.

## CHAPTER 6

### GENERAL MAINTENANCE INSTRUCTIONS

#### Section I. SPECIAL TOOLS AND EQUIPMENT

##### 129. Special Tools and Equipment

No special tools or equipment are required by direct support, general support, and depot maintenance personnel for performing maintenance on the heater.

##### 130. Direct Support, General Support and Depot Maintenance Repair Parts

Direct support, general support, and depot

maintenance repair parts are listed and illustrated in TM 5-4520-208-25P.

##### 131. Specially Designed Tools and Equipment

No specially designed tools and equipment are required by direct support, general support, and depot maintenance personnel for performing maintenance on the heater.

#### Section II. TROUBLESHOOTING

##### 132. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the heater or any of its components. Each trouble symptom stated is followed by a list of probable causes of trouble. The possible remedy recommended is described opposite the probable causes.

##### 133. Gasoline Engine Power Unit Troubles

For a listing of troubles and possible remedies pertaining to the Model 1A08-III Military Standard Engine, refer to TM 5-2805-208-14.

##### 134. Electric Motor Power Unit Lacks Power

Probable cause	Possible remedy
Bearings defective.....	Repair electric motor (para 172).

##### 135. Electric Motor Power Unit Overheats

Probable cause	Possible remedy
Rotor and/or windings defective.	Repair electric motor (para 172).
Bearings defective.....	Repair electric motor (para 172).

##### 136. Electric Motor Power Unit Noisy

Probable cause	Possible remedy
Motor interior dirty.....	Clean the motor.
Bearings dirty or worn.....	Clean bearings or repair electric motor (para 172).

##### 137. Heater Ignition Fails

*Note.* To determine whether failure of the heater to ignite is caused by a faulty ignition system or fuel system, it will expedite localizing the fault if the following method is used. Remove the clamp, nozzle holder, and combustor plate (para 77). If raw fuel is present in the combustion chamber, inspect the trouble symptoms pertaining to the ignition system. If no raw fuel is present in the combustion chamber, inspect the trouble symptoms pertaining to the fuel system.

Probable cause	Possible remedy
Magneto points defective....	Replace magneto point contact set (para 159).
Magneto defective.....	Repair magneto (para 159).
Fuel pump defective.....	Repair fuel pump (para 155).

### 138. Heater Exhaust Smoking Excessively

Probable cause	Possible remedy
----------------	-----------------

Air flow restricted.....	Remove restriction.
--------------------------	---------------------

### 139. Combustor Fire Cuts Out on Overheat

Probable cause	Possible remedy
----------------	-----------------

Temperature selector valve sensing element capillary tube ruptured.	Replace temperature selector valve (paras 100 and 157).
---	---

### 140. Combustor Fire Fails to Cut Out on Overheat

Probable cause	Possible remedy
----------------	-----------------

Temperature selector valve defective.	Replace defective temperature selector valve (paras 100 and 157).
---------------------------------------	---

### 141. Discharge Air Temperature Not in Correct Range or Temperature Fluctuates

Probable cause	Possible remedy
----------------	-----------------

Temperature selector valve defective.	Replace defective temperature selector valve (paras 100 and 157).
---------------------------------------	---

### 142. Maximum Heat Not Obtainable

Probable cause	Possible remedy
----------------	-----------------

Fuel control damaged.....	Replace fuel control (paras 100 and 157).
Temperature selector valve defective.	Replace defective temperature selector valve (paras 100 and 157).
Combustor or heat exchanger damaged.	Replace combustor or heat exchanger (paras 161 and 165).

## Section III. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

### 143. Power Units

Refer to paragraph 12 for removal and installation of the gasoline engine and electric motor power units.

### 144. Heater Magneto

Refer to paragraph 82 for removal and installation of the heater magneto.

### 145. Heater Fuel Pump

a. BT400-40. Refer to paragraph 85 for removal and installation of the heater fuel pump.

b. BT400-40-1. Refer to paragraph 90 for removal and installation of the heater fuel pump.

### 146. Vaneaxial Fan and Mounting Ring

Refer to paragraph 77 for removal and disassembly of the vaneaxial fan and mounting ring.

### 47. Fuel Atomizing Nozzle

a. BT400-40. Refer to paragraph 87 for removal and installation of the fuel atomizing nozzle.

b. BT400-40-1. Refer to paragraph 92 for removal and installation of the fuel atomizing nozzle.

### 148. Fuel Control Components

Refer to paragraph 97 through 100 for removal and installation of control tube assemblies, fuel valves, and discharge temperature gage.

### 149. Heater Exhaust System

Refer to paragraph 79 and 80 for removal and installation of the engine exhaust extensions and exhaust stack.

### 150. Heater Combustor

#### a. Removal.

- (1) Remove power unit (para 12).
- (2) Remove combustor plate (para 83).
- (3) Remove nozzle holder (para 87, BT-400-40 or para 92, BT400-40-1).
- (4) Remove 16 self-locking nuts (9, fig. 35) and flat washers (8) securing combustor assembly (6) to heat exchanger. Remove combustor and gasket (7) from heat exchanger.

#### b. Installation.

- (1) Position the gasket (7, fig. 36) and combustor assembly (6) on heat exchanger. Locking tabs on combustor must be in a vertical position. Secure



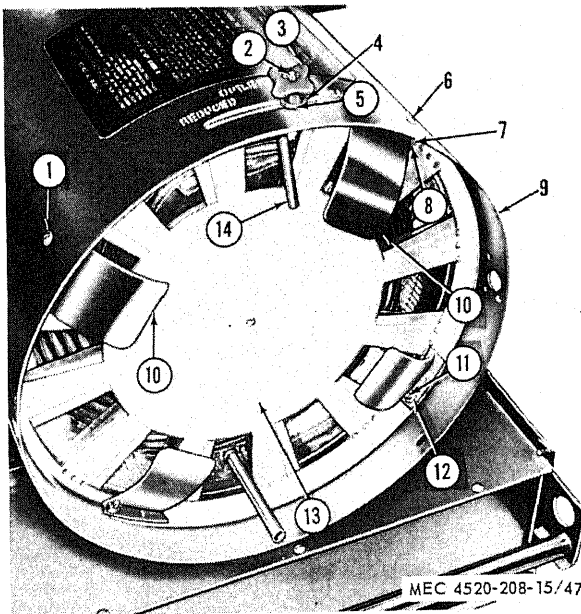
combustor with 16-self-locking nuts (9) and flat washers (8).

- (2) Install combustor plate (5) as described in paragraph 83.
- (3) Install nozzle holder (par. 87, BT-400-40 or para 92, BT400-40-1).
- (4) Install power unit (para 12).

## 151. Air Control Components

### a. Removal.

- (1) Remove duct adapter assembly and sensing units (paras 99 and 100)
- (2) Remove cotter pin (2, fig. 47), handwheel (3), flat washer (4), and rubber washer (5) and remove damper control (14).



- 1 Screw, machine, No. 10-24 x 3/8 in (3)
- 2 Pin, cotter, 1/16 x 1/2 in.
- 3 Handwheel
- 4 Washer, flat, 1/4 in.
- 5 Washer, rubber
- 6 Screw, machine, No. 10-24 x 3/8 in. (4)
- 7 Washer, lock, No. 10 (4)
- 8 Nut, plain, hex, No. 10-24 (4)
- 9 Casing
- 10 Air control baffle (4)
- 11 Washer, lock, No. 10 (3)
- 12 Nut, plain, hex, No. 10-24 (3)
- 13 Air control
- 14 Damper control

Figure 47. Air control, removal points.

- (3) Remove four screws (6), lockwashers (7), and nuts (8) securing four air control baffles (10) to the air control (13) and remove air control baffles.
- (4) Remove three screws (1), lockwashers (11), and nuts (12) securing air control to casing (9) and remove air control.
- (5) Remove two nuts (10, fig. 49) and lockwashers (11) and remove bulb support (13) from duct adapter assembly.

### b. Installation.

- (1) Position the air control (13, fig. 47) in casing (9) and install three screws (1), lockwashers (11), and nuts (12).
- (2) Position the four air baffles (7, fig. 48) on air control and secure with four screws (6), lockwashers (8), and nuts (9).
- (3) Install bulb support (13) on duct adapter (12) and secure with four nuts (10) and two lockwashers (11).
- (4) Install damper control (14, fig. 48) and secure with rubber washer (5), flat washer (4), handwheel (3), and cotter pin (2).
- (5) Install sensing units and duct adapter assembly (paras 99 and 100).

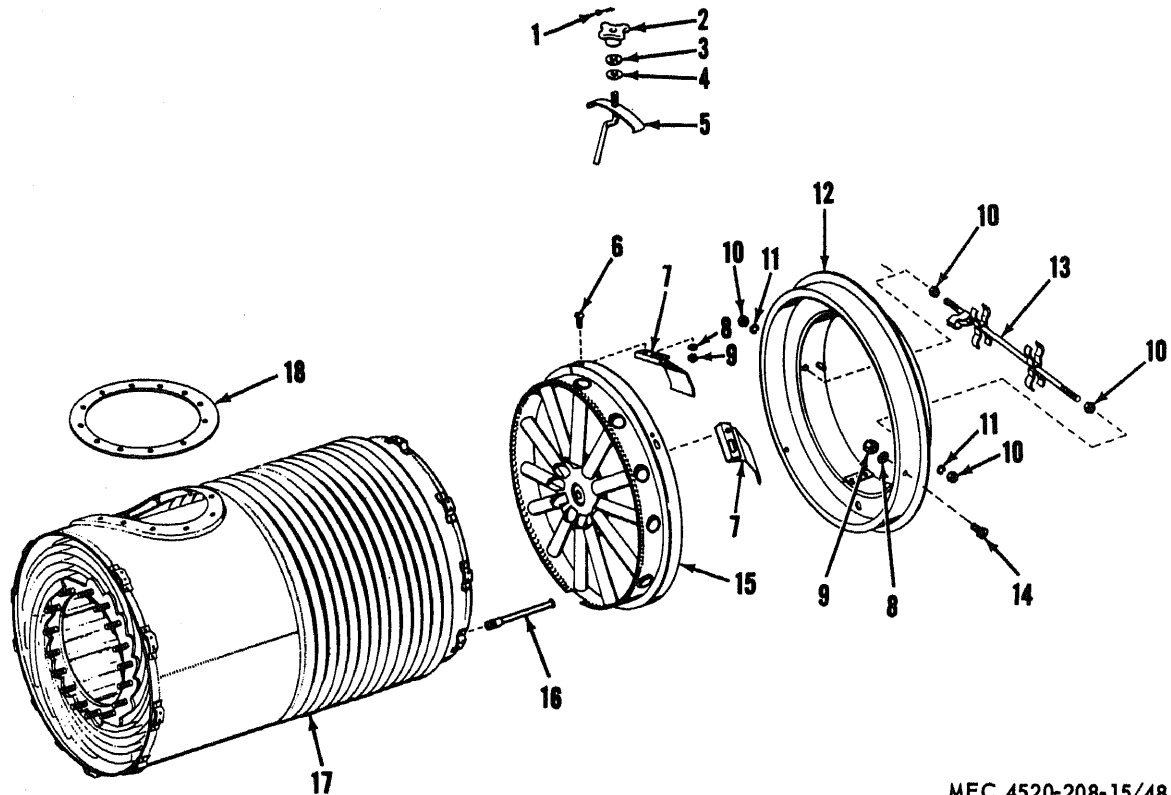
## 152. Heat Exchanger

### a. Removal.

- (1) Removal power unit (para 12).
- (2) Remove the exhaust stack (para 80).
- (3) Remove the combustor (para 150).
- (4) Remove the air control (para 151).
- (5) Slide the heat exchanger (17, fig. 48) from the casing.
- (6) Remove gasket (18).

### b. Installation.

- (1) Slide heat exchanger (17, fig. 48) into casing and position to line up exhaust stack holes in heat exchanger with holes in casing and gasket (18).
- (2) Install the air control (para 151).
- (3) Install exhaust stack (para 80).
- (4) Install combustor (para 150).
- (5) Install power unit (para 12).



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- |   |  |
|---|--|
| 1 Pin, cotter, 1/16 x 1/2 in.             | 10 Nut, plain, hex, No. 10-24 (4)              |
| 2 Handwheel                               | 11 Washer, lock, IT, No. 10 (2)                |
| 3 Washer, flat, 1/4 in.                   | 12 Duct adapter                                |
| 4 Washer, nonmetallic                     | 13 Support, bulb                               |
| 5 Damper control                          | 14 Screw, machine, No. 10-24 x 3/8 Phil hd (8) |
| 6 Screw, machine, No. 10-24 x 3/8 in. (4) | 15 Air Control                                 |
| 7 Air baffle (4)                          | 16 Drain tube                                  |
| 8 Washer, lock, No. 10 (7)                | 17 Heat exchanger                              |
| 9 Nut, plain, hex, No. 10-24 (7)          | 18 Gasket                                      |

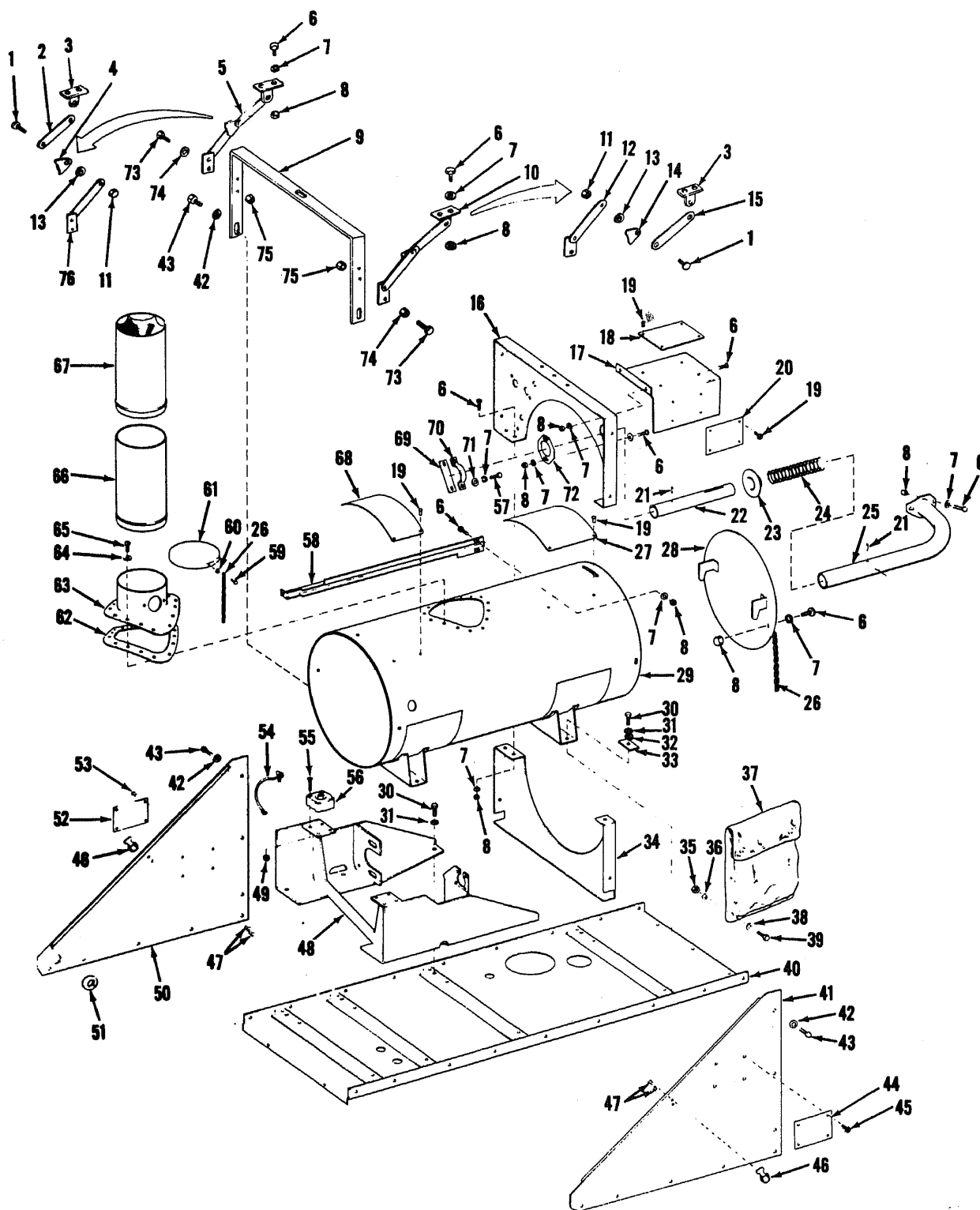
Figure 48. Heater exchanger and air control, exploded view.

### 153. Casing, Bulkheads, and Base

#### a. Removal.

- (1) Remove power unit (para 12), and cabinet (para 70).
- (2) Remove fuel pump and tube assemblies (para 85, BT400-40 or para 90, BT400-40-1).
- (3) Remove power unit hose assembly (para 86, BT400-40 or para 91, BT400-40-1).
- (4) Remove fuel atomizing nozzle (para 87, BT400-40 or par. 92, BT400-40-1).
- (5) Remove heater fuel filter (para 88, BT400-40 or para 93, BT400-40-1).
- (6) Remove fuel tank (para 95) and heater controls and block (para 100).
- (7) Remove engine exhaust pipe (para 79) and exhaust stack (para 80).
- (8) Remove magneto (para 82) and ignition cable (para 83).
- (9) On Model BT400-40, remove time totalizing meter (para 102).
- (10) Remove air control (para 151).
- (11) Remove heat exchanger (para 152).
- (12) Remove sixteen screws (43, fig. 49) and lockwashers (42) and remove left and right side panels (41 and 50)

- (13) Remove three screws (6), lockwashers (7) and nuts (8) and remove top bulkhead (16) from heater.
  - (14) Remove four screws (30), lockwashers (31), flat washers (32), and special washers (33). Remove casing (29) from skid top. Remove bottom bulkhead (34).
  - (15) Remove eight screws (55) and self-locking nuts (49) and remove two thumb screws (54) and resilient mounts (56).
  - (16) Remove six screws (30) and lockwashers (31) and remove power unit support (48).
- b. *Installation.*
- (1) Install power unit support (48, fig. 49) on skid cover (40) and secure with six screws (30) and lockwashers (31).
  - (2) Install two resilient mounts (56) and thumb screws (54) and secure with eight screws (55) and self-locking nuts (49).
  - (3) Install bottom bulkhead (34) on skid cover. Install casing (29) and secure with four screws (30), lockwashers (31), flat washers (32), and special washers (33).
  - (4) Install top bulkhead (16) over casing and secure to bottom bulkhead with three screws (6), lockwashers (7), and nuts (8).
  - (5) Install left and right side panels (41 and 50) and secure with sixteen screws (43) and lockwashers (42).
  - (6) Install heat exchanger (para 152).
  - (7) Install air control (para 151).
  - (8) On Model BT400-40, install time totalizing meter (para 102).
  - (9) Install magneto (para 82) and ignition cable (para 83).
  - (10) Install exhaust system components (paras 79 and 80).
  - (11) Install fuel tank (para 95) and heater controls and block (para 100).
  - (12) Install heater fuel filter (para 88, BT400-40 or para 93, BT400-40-1).
  - (13) Install fuel atomizing nozzle (para 87, BT400-40 or para 92, BT400-40-1).
  - (14) Install power unit hose assembly (para 86, BT400-40 or para 91, BT400-40-1).
  - (15) Install fuel pump and tube assemblies (para 85, BT400-40 or para 90 BT-400-40-1).
  - (16) Install cabinet (para 70) and power unit (para 12).

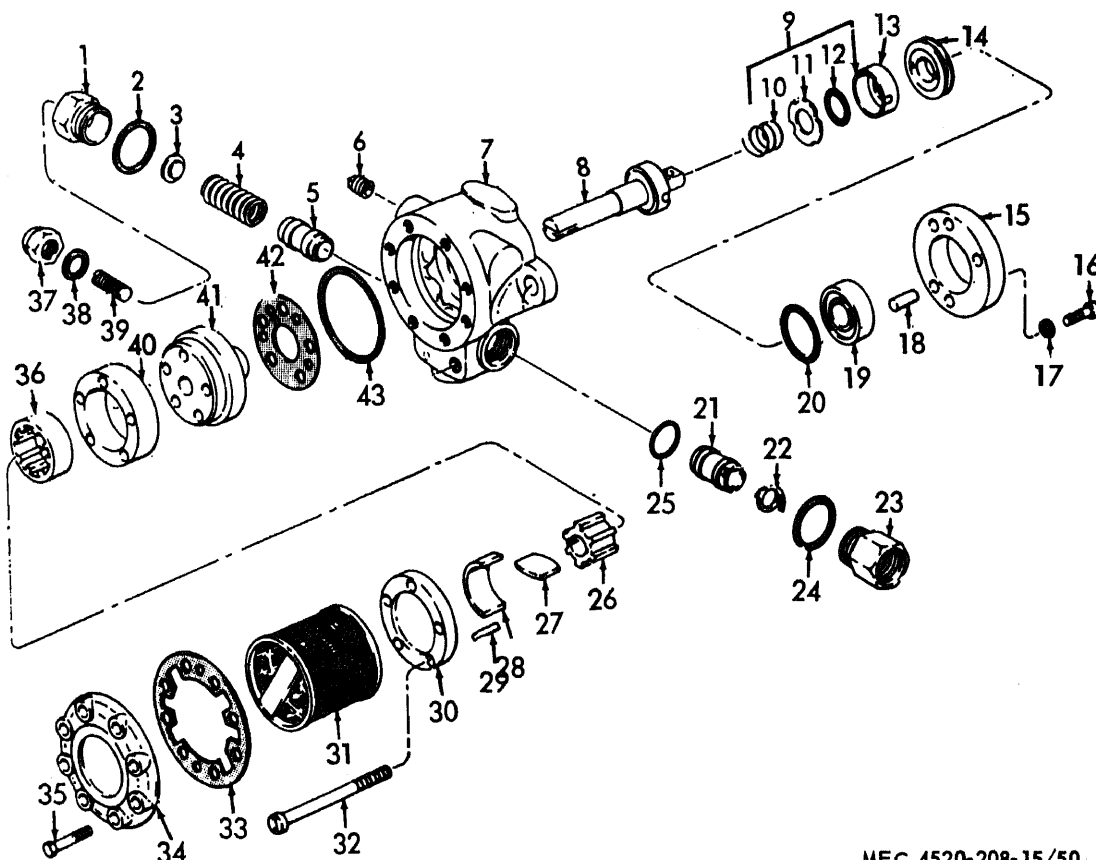


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Figure 49. Casing, bulkheads, and power unit support, exploded view.

- 1 Carriage bolt (2) (BT400-40-1)
- 2 Removable bar, right hand (BT400-40-1)
- 3 Support bracket (2) (BT400-40-1)
- 4 Support stop, right hand (BT400-40-1)
- 5 Top door support, right side (BT400-40-1)
- 6 Screw, machine, No. 10-24 x 3/8 in.  
(13 rqr on BT400-40, 17 rqr on BT400-40-1)
- 7 Washer, lock, IT, No. 10 (15 rqr on BT400-40, 19 rqr on BT400-40-1)
- 8 Nut, plain, hex, No. 10-24 (13 rqr on BT400-40, 17 rqr on BT400-40-1)
- 9 Hinge support bracket (BT400-40-1)
- 10 Top door support, left side (BT400-40-1)
- 11 Nut, plain, hex (2) (BT400-40-1)
- 12 Bar assembly, left hand (BT400-40-1)
- 13 Fiber washer (2) (BT400-40-1)
- 14 Support stop, left hand (BT400-40-1)
- 15 Removable bar, left hand (BT400-40-1)
- 16 Upper bulkhead
- 17 Exhaust shield
- 18 Identification plate (BT400-40)
- 19 Rivet, blind, 1/8 x 3/16 in. (12)
- 20 Identification plate (BT400-40-1)
- 21 Pin, tapered, plain (2)
- 22 Exhaust conductor
- 23 Flange
- 24 Helical compression spring
- 25 Exhaust pipe
- 26 Chain (2)
- 27 Master instruction plate
- 28 Adapter outlet cover
- 29 Casing
- 30 Bolt, machine, hex hd, 5/16-18 x 1/2 in. (10)
- 31 Washer, lock, IT, 5/16 in (10)
- 32 Washer, flat, 5/16 in. (4)
- 33 Washer, special (4)
- 34 Lower bulkhead
- 35 Nut, plain, hex, 1/4-20 (3)
- 36 Washer, lock, 1/4 in. (3)
- 37 Publications case
- 38 Washer, lock, 1/4 in. (3)
- 39 Screw, cap, hex hd, 1/4-20 x 3/4 in. (3)
- 40 Skid cover
- 41 Left side panel
- 42 Washer, lock, IT, 1/4 in. (16 rqr on BT400-40, 19 rqr on BT400-40-1)
- 43 Screw, cap, hex hd, 1/4-20 x 1/2 (16 rqr on BT400-40, 19 rqr on BT400-40-1)
- 44 Identification plate (BT400-40-1)
- 45 Rivet (4) (BT400-40-1)
- 46 Latch (2)
- 47 Rivet, tubular (4)
- 48 Power unit support
- 49 Nut, self-locking, hex, No. 10-24 (8)
- 50 Right side panel
- 51 Grommet, rubber
- 52 Identification plate
- 53 Rivet (4)
- 54 Thumb screw (2)
- 55 Screw, machine, No. 10-24 x 1-5/8 in. (8)
- 56 Resilient mount (2 rqr)
- 57 Screen, machine, No. 10-24 x 7/8 (2)
- 58 Capillary tube shield
- 59 Rivet, tubular
- 60 Washer, flat, No. 8
- 61 Exhaust stack cover
- 62 Gasket
- 63 Exhaust stack
- 64 Washer, flat, No. 8 (12)
- 65 Screw, Machine, No. 8-32 x 3/4 in. (12)
- 66 Exhaust pipe, w/out screen
- 67 Exhaust pipe, w/screen
- 68 Fuel system diagram instruction plate
- 69 Spacers (as rqr)
- 70 Bracket
- 71 Washer, flat, No. 10 (2)
- 72 Exhaust flange
- 73 Screw, machine, No. 8-32 x 3/8 in. (4)  
(BT400-40-1)
- 74 Washer, lock, IT, No. 8 (4) (BT400-40-1)
- 75 Nut, plain, hex, No. 8-32 (4) (BT400-40-1)
- 76 Bar assembly, right hand (BT400-40-1)

Figure 49—Continued.



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- |   |   |
|---|---|
| 1 End plug                                    | 23 End plug                                   |
| 2 Washer, nonmetallic (gasket)                | 24 Washer, nonmetallic (gasket)               |
| 3 Spring seat                                 | 25 Packing, preformed                         |
| 4 Helical compression spring                  | 26 Roller                                     |
| 5 Piston                                      | 27 Drive key                                  |
| 6 Pipe plug, 1/4 NPT                          | 28 Crescent                                   |
| 7 Pump body                                   | 29 Pin (2)                                    |
| 8 Pump shaft                                  | 30 End plate                                  |
| 9 Pump seal assembly                          | 31 Strainer                                   |
| 10 Spring                                     | 32 Screw, machine, No. 10-32 x 1 5/8 in. (5)  |
| 11 Spring washer                              | 33 Gasket                                     |
| 12 Packing, preformed                         | 34 Pump cover                                 |
| 13 Seal housing                               | 35 Screw, cap, hex hd, 1/2-20 x 1 1/8 in. (8) |
| 14 Seal face                                  | 36 Rotor                                      |
| 15 Bearing retainer                           | 37 End cap nut                                |
| 16 Screw, machine, No. 10-32 x 1/2 in. (3)    | 38 Gasket                                     |
| 17 Washer, lock, IT, No. 10 (3)               | 39 Adjusting screw                            |
| 18 Pin, grooved, headless, 3/16 x 1/2 in. (2) | 40 Rotor housing                              |
| 19 Ball bearing, annular                      | 41 Port housing                               |
| 20 Packing, preformed                         | 42 Gasket                                     |
| 21 Piston sleeve                              | 43 Gasket                                     |
| 22 Retainer sleeve                            |   |

Figure 50. Fuel pump, exploded view.

## CHAPTER 7

### SPECIFIC REPAIR INSTRUCTIONS

#### Section I. FUEL PUMP

##### 154. General

Fuel is drawn from the fuel tank by the fuel pump. The pump is driven by the V-belt and is operating continuously whenever the power unit is operating.

##### 155. Fuel Pump

*a. Removal.* Remove the fuel pump (para 85, BT400-40 or par. 90, BT400-40-1).

*b. Disassembly.*

- (1) Remove eight screws (35, fig. 50) securing pump cover (34) to fuel pump body (7) and remove pump cover, gasket (33), and strainer (31).
- (2) Remove five screws (32) and remove end plate (30). Remove assembled rotor housing (40), rotor (36), roller (26), and drive key (27).
- (3) Remove drive key, roller, and rotor from rotor housing.
- (4) Remove crescent (28) and two pins (29) from end plate (30).
- (5) Remove port housing (41) and gaskets (42 and 43).
- (6) Remove three screws (16) and lockwashers (17) securing bearing retainer to pump body and remove bearing retainer. Remove ball bearing (19) and two pins (18) from retainer.
- (7) Pull the drive shaft (8) from pump body. Remove seal (14) from drive shaft and packing (20) from seal. Discard packing.
- (8) Remove seal housing (13) and packing (12) from drive shaft.
- (9) Remove spring washer (11) and spring (10) from seal housing.

(10) Remove end plug (1), washer (2), spring seat (3), and spring (4) from pump body.

(11) Remove end cap nut (37) and gasket (38) from adjusting screw end plug (1) and remove adjusting screw (39).

(12) Remove nozzle end plug (23), piston sleeve washer (22) and gasket (24) from pump body.

(13) Press the piston (5) and piston sleeve (21) from pump body. Remove and discard packing (25).

(14) Remove pipe plug (6).

*c. Cleaning, Inspection, and Repair.*

(1) Clean all parts with approved cleaning solvent and dry thoroughly.

(2) Inspect piston seat on adjusting screw end plug and piston to determine whether valve will seat properly. Replace both parts if seat is scratched or damaged.

(3) Inspect roller and rotor for chipped, cracked, worn, or broken teeth. Replace damaged parts.

(4) Insert piston in piston sleeve and move in and out to check for binding. Dress piston with crocus cloth if necessary to relieve binding.

*d. Assembly and Installation.*

(1) Install pipe plug (6, fig. 50) in pump body (7).

(2) Install gasket (2) and adjusting screw end plug (1) in the pump body

(3) Install new packing (25) on piston sleeve (21), coat the piston sleeve with oil, and insert piston sleeve in pump body until sleeve contacts adjusting screw end plug.

- (4) Remove adjusting screw end plug (1). Install the piston (5), piston spring (4), spring seat (3), gasket (2), and install adjusting screw end plug to secure parts.
- (5) Position the piston sleeve washer (22) on the piston sleeve (21) and gasket (24) on nozzle end plug (23) and install end plug in pump body.
- (6) Insert spring (10) into seal housing (13) on rotor shaft and secure with spring washer (11).
- (7) Install new packing (12) and seal housing on drive shaft.
- (8) Install new packing (20) on seal (14) and install seal on drive shaft.
- (9) Position the drive shaft, with seals, in pump body.
- (10) Pack ball bearing (19) in grease (MIL-G-23827) and press bearing into bearing retainer (15). Install two pins (18) in bearing retainer.
- (11) Install retainer and bearing on drive shaft and secure with three screws (16) and lockwashers (17).
- (12) Install gasket (42 and 43) on port housing (41) and install housing on

pump body. Position port housing to align mounting holes in housing with holes in pump body.

- (13) Install two pins (29) and crescent (28) on end plate (30).
- (14) Place rotor (36) in rotor housing (40) and position both over crescent on end plate. Install roller (26) and drive key (27) in rotor.
- (15) Install end plate, with associated parts on drive shaft, with slot in shaft engaging drive key.
- (16) Align end plate (30), rotor housing (40), and port housing (41) with one screw (32). Install second screw (32) but do not tighten.
- (17) Install remaining three screws (32) and tighten each screw alternately, a little at a time, until all five screws are tight.
- (18) Position strainer (31), gasket (33), and pump cover (34) on pump body (7) and secure with eight screws (35).
- (19) Install and adjust fuel pump (para 85, BT400-40 or par. 90, BT400-40-1).

## Section II. FUEL CONTROL

### 156. General

a. The fuel control is the centralized control of fuel flow to the heater. The fuel valves control fuel to the burner and select and regulate the discharge air temperature.

b. The two valves are coupled together with a block, which also serves as a mount for the valves. An overflow tube carries excess fuel from the block to the fuel tank.

### 157. Fuel Control

a. *Removal.* Remove the block with the valves attached (para 100).

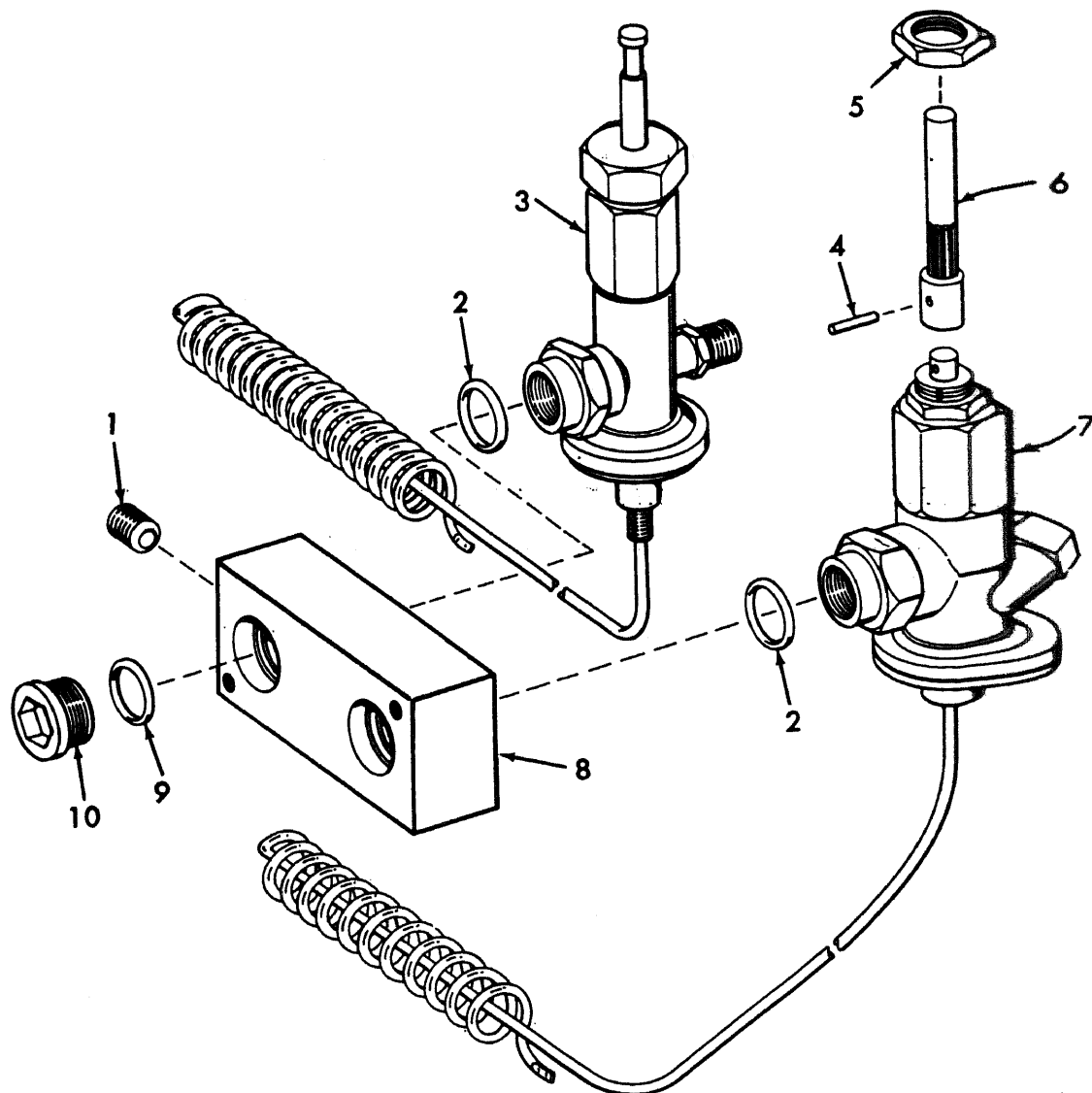
b. *Disassembly.*

- (1) Remove two bolts (10, fig. 51) and remove fuel control valve (3) and temperature selector valve (7) from block (8). Remove two preformed

packings (9) from block. Remove two preformed packings (2) from block. Discard preformed packings.

- (2) Drive spring pin (4) from stem (6) and temperature selector valve (7). Remove stem.
  - (3) Remove pipe plug (1) from block.
- c. *Cleaning, Inspection, and Repair.*
- (1) Clean the valves with a cloth dampened in an approved cleaning solvent and dry thoroughly.
  - (2) Clean all metal parts in an approved cleaning solvent and dry thoroughly. Clean all passages in block with particular care.
  - (3) Inspect all parts for breaks, cracks, bends, dents, damaged teeth, damaged threads, enlarged openings, or other damage.





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- 1 Pipe plug, 1/8 NPT
- 2 Packing, preformed (2)
- 3 Fuel control valve
- 4 Pin, spring
- 5 Nut, stamped

- 6 Stem
- 7 Temperature selector valve
- 8 Block
- 9 Packing, preformed (2)
- 10 Bolt (2)

Figure 51. Fuel control valves and block, exploded view.

- (4) Replace damaged parts and valves proven to be inoperative by valve test outlined in paragraph 100.
- (5) If control valves are frozen, place valves in a flexible duct of 225°F.

Heating valves above boiling point of water will vaporize any moisture in the valves. Blow out valves with compressed air and dry in flexible duct for an additional thirty minutes to remove all moisture.

- (6) Inspect capillary tubes and sensing units for cracked, kinked, or collapsed condition. Replace valve if any damage is noted.

*d. Assembly and Installation.*

- (1) Install stem (6, fig. 51) on shaft of temperature control valve (7) and drive spring pin (4) through stem and shaft.

- (2) Install two new preformed packings (2) and two preformed packings (9) in bores of block (8). Install fuel control valve (3) and temperature selector valve (7) in block and secure with two bolts (10).
- (3) Install pipe plug (1) in block.
- (4) Install block, with attached valves, on heater (para 100).

### Section III. MAGNETO

#### 158. General

The magneto, driven by the power unit, supplies the high-tension spark necessary for ignition of the fuel-air mixture in the heater combustor.

#### 159. Magneto

*a. Removal.* Remove the magneto (para 82).

*b. Disassembly.*

- (1) Remove four screws (1, fig. 52) and lockwashers (2) and remove end cap (3) and gasket (4) from housing (34). Remove cable outlet (29) from end cap.
- (2) Remove screw (14) and remove leads and breaker arm (31) from support bracket (33).
- (3) Remove screw (5) and lockwasher (6) and remove capacitor (7).
- (4) Remove retaining ring (30) and remove breaker arm from rotor bearing support (15).
- (5) Remove screw (8), lockwasher (9), and flat washer (10) and remove cam wick and holder (11) from rotor bearing support.
- (6) Remove screw (12), lockwasher (6) and flat washer (13) and remove stationary support bracket from rotor bearing support.
- (7) Remove four screws (32) that secure rotor bearing support (15) to housing and remove rotor bearing support.

Remove sleeve bearing (28) from support.

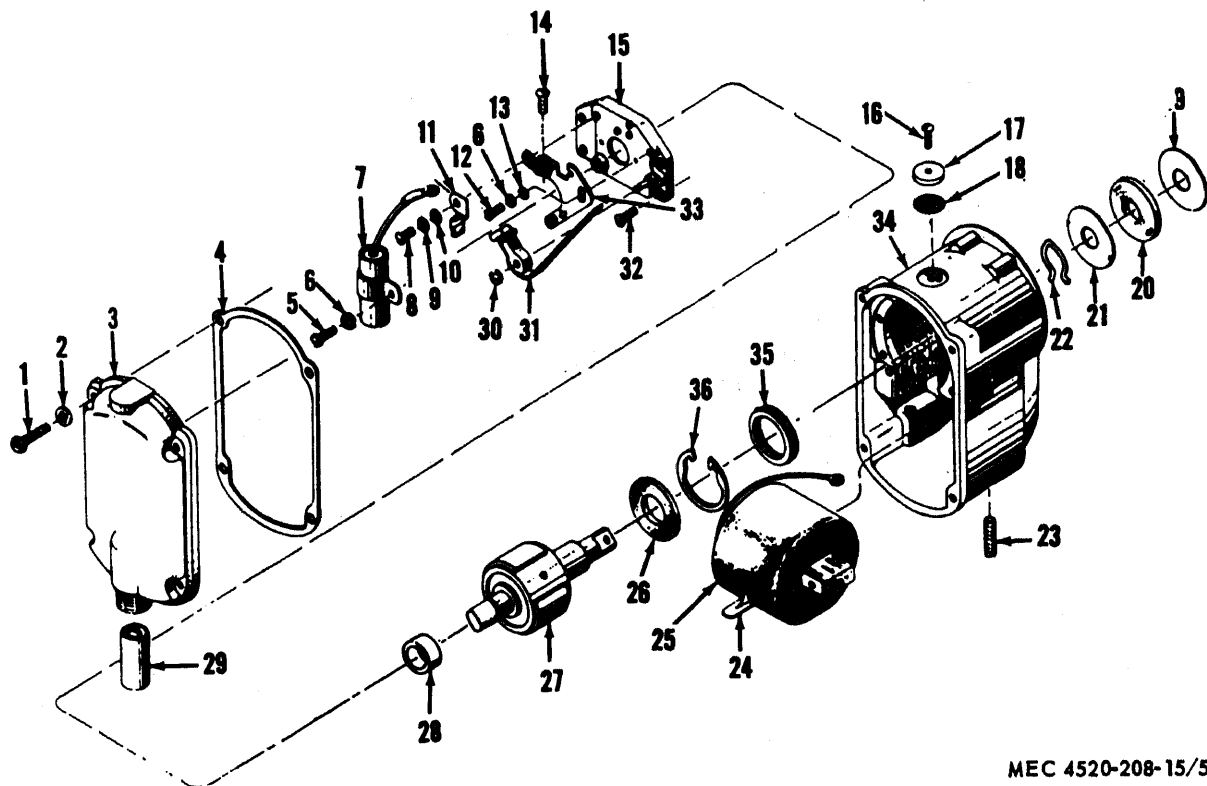
- (8) Remove staking and remove outer flat washer (19), seal (20), inner flat washer (21), and retaining ring (22) from housing.
- (9) Remove magneto rotor (27) from housing (34). Remove cork seal (26) from rotor. Remove retaining ring (36) and ball bearing (35) from housing.
- (10) Remove two setscrews (23) from housing and remove coil (25). Remove screw (16), drain cover (17), and screen (18).

*c. Cleaning, Inspection, and Repair.*

- (1) Clean all metal parts with a cloth dampened with an approved cleaning solvent and dry thoroughly.
- (2) Wipe the coil, capacitor, and interior of housing with a clean, dry, lint-free cloth.
- (3) Inspect all parts for breaks, cracks, bends, damaged threads, or other damage. Replace all damaged parts.
- (4) Inspect the points for burning or pitting. Dress slightly burned or pitted points, using a fine mill file or point dresser. Replace the stationary support bracket and breaker arm if points are badly worn or burned.

*d. Assembly and Installation.*

- (1) Position the coil (25, fig. 52) in the housing (34) and secure with two setscrews (23). Install ball bearing



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- |  |   |
|--|---|
| 1 Screw, assembled, machine, No. 10-24 x 5/8 in. (4) | 19 Outer flat washer                      |
| 2 Washer, lock, IT, No. 10 (4)                       | 20 Magneto packing                        |
| 3 End cap  | 21 Inner flat washer                      |
| 4 Gasket   | 22 Retaining clip                         |
| 5 Screw, machine, No. 6-32 x 5/16 in.                | 23 Setscrew, 1/4-20 x 3/4 in. (3)         |
| 6 Washer, lock, No. 6 (2)                            | 24 Electrical contact                     |
| 7 Capacitor, fixed                                   | 25 Magneto coil                           |
| 8 Screw, machine, No. 8-32 x 3/8 in.                 | 26 Cork bearing oil seal                  |
| 9 Washer, lock, No. 8                                | 27 Magneto rotor                          |
| 10 Washer, flat, No. 8                               | 28 Sleeve bearing                         |
| 11 Cam wick and holder                               | 29 Cable outlet                           |
| 12 Screw, machine, No. 6-32 x 3/8 in.                | 30 Retaining ring                         |
| 13 Washer, flat, No. 6                               | 31 Breaker arm                            |
| 14 Screw, machine, No. 6-32 x 3/8 in.                | 32 Screw, machine, No. 8-32 x 3/8 in. (4) |
| 15 Rotor bearing support                             | 33 Stationary support bracket             |
| 16 Screw, machine, No. 6-32 x 5/16 in.               | 34 Housing                                |
| 17 Hood  | 35 Ball bearing, annular                  |
| 18 Screen  | 36 Retaining ring                         |

Figure 52. Magneto, exploded view.

- (35) in housing and secure with re-training ring (36).
- (2) Install cork seal (26), on shaft of magneto rotor (27). Position the rotor in housing.
- (3) Install retaining ring (22) on rotor shaft. Place the inner flat washer (21), seal (20), and outer flat washer (19) in bore of housing (34). Stake housing in three places to secure.

- (4) Install sleeve bearing (28) in the rotor bearing support (15). Install the support on the housing, with the rotor shaft entering bore of support. Secure support to housing with four screws (32).
- (5) Install the stationary support bracket (33) on rotor bearing support and secure with screw (12), lockwasher (6), and flat washer (13).
- (6) Position cam wick and holder (11) on rotor bearing support and secure with screw (8), lockwasher (9), and flat washer (10).
- (7) Place the breaker arm (31) on shaft of rotor bearing support and secure with retaining ring (30).
- (8) Position capacitor (7) on rotor bearing support and secure with screw (5) and lockwasher (6).
- (9) Position the breaker arm lead to coil (25), and lead of capacitor (7) and secure to stationary support bracket (33) with screw (14).
- (10) Adjust the magneto points (para 82b).
- (11) Install cable outlet (29) in end cap (3) and position end cap and gasket (4) on housing (34). Secure end cap to housing with four screws (1) and lockwashers (2).
- (12) Install screen (18), and drain cover (17) and secure with screw (16).
- (13) Refer to paragraph 82 and install the magneto.

#### Section IV. COMBUSTOR

##### 160. General

The combustor is a perforated, cylindrical metal housing attached to the heat exchanger. A removable plate seals the one end of the combustor and mounts the fuel atomizing nozzle and igniter plug.

##### 161. Combustor

###### a. Removal.

- (1) Remove the igniter plug (para 83) and fuel atomizing nozzle (para 87, BT400-40 or para 92, BT400-40-1).
- (2) Remove the combustor (para 150).

###### b. Cleaning, Inspection, and Repair.

- (1) Clean the combustor plate (5, fig. 35), combustor assembly (6), lock washers (8), and nuts (9) with an approved

cleaning solvent and dry thoroughly. Clean all perforations with a wire brush to remove all soot or obstructions.

- (2) Inspect for bends, dents, cracks, or other damage. Straighten minor bends and dents, weld small cracks, or replace plate and combustor as an assembly if damaged cannot be repaired.
- (3) Replace gasket (7) if torn or distorted. Replace all missing or damaged nuts and flat washers.

###### c. Installation.

- (1) Install combustor (para 150).
- (2) Install igniter plug (para 83) and fuel atomizing nozzle (para 87, BT400-40 or para 92, BT400-40-1).

#### Section V. AIR CONTROL

##### 162. General

a. The air control is mounted within the outlet end of the casing.

b. The air control consists of a central baffle plate, a series of radial tubes, and an adjustable damper.

##### 163. Air Control

###### a. Removal.

- (1) Remove duct adapter assembly (para 99).
- (2) Remove air control (para 151).

*b. Cleaning, Inspection, and Repair.*

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect air control (15, fig. 48), and duct adapter (12), and parts for breaks, cracks, bends, dents, damaged threads, or other damage. Straighten minor bends or dents or replace damaged parts.

- (3) Check operation of the air control damper. Damper must not bind or have any restriction of movement. If there is binding or restriction, correct cause or replace air control.

*c. Installation.*

- (1) Install air control (para 151).
- (2) Install duct adapter assembly (para 99).

**Section VI. HEAT EXCHANGER****164. General**

*a.* The heat exchanger is a cylindrical drum containing circularly nested parallel tubes having airfoil cross sections.

*b.* A drain tube is provided at the outlet end to drain accumulations of fuel or moisture in the heat exchanger.

**165. Heat Exchanger**

*a. Removal.* Refer to paragraph 152 and remove the heat exchanger.

*b. Disassembly.* Remove drain tube (16, fig. 48) from outlet end of heat exchanger (17).

*c. Cleaning, Inspection, and Repair.*

- (1) Clean interior of heat exchanger (17, fig. 38) with a wire brush and compressed air. Clean the exterior surface with a clean cloth and an approved cleaning solvent.

- (2) Inspect heat exchanger for bends, dents, cracks, or other damage. Straighten bent tubes. Replace heat exchanger if damaged.

*d. Assembly and Installation.* Install drain tube (16, fig. 48) in heat exchanger (17). Refer to paragraph 152 and install the heat exchanger.

**Section VII. CASING, AIR STRAIGHTENING VANE, AND SKID BASE****166. Casing**

*a. General.* The casing (9, fig. 47) provides a protective covering around the heat exchanger.

*b. Removal.* Refer to paragraph 153 and remove the casing.

*c. Cleaning, Inspection, and Repair.*

- (1) Clean the casing (29, fig. 49), side panel (41 and 50), and bulkheads (16 and 34), with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the casing, panels, and bulkheads for breaks, cracks, dents, chipped paint, or other damage. Check weld nuts for damaged threads and secure attachment. Straighten minor dents and weld small breaks and cracks. Paint exposed areas. Refer to TM 9-213. Replace damaged parts.

*d. Installation.* Refer to paragraph 153 and install outer casing.

**167. Air Straightening Vane**

*a. General.* The air straightening vane (19, fig. 25) is mounted on the fan ring forward of the fan.

*b. Removal.* Refer to paragraph 77 and remove the air straightening vane.

*c. Cleaning, Inspection, and Repair.*

- (1) Clean air straightening vane (19, fig. 25) in approved cleaning solvent and dry thoroughly.
- (2) Inspect air straightening vane for bends, breaks, or other damage. Straighten minor bends. Replace vane if damaged.

*d. Installation.* Refer to paragraph 77 and install air straightening vane.

## 168. Skid Base and Cover

*a. General.* The skid cover supports the casing and power unit support. The skid base incloses the fuel tank and provides a base for the heater. The fuel tank hangers are bolted to the skid cover, and set into the skid base with the base and cover bolted together to provide an inclosure and means of sliding the heater from place to place. Handles on the skid base provide strapping facilities when heater is mounted on the trailer.

*b. Removal.* Refer to paragraph 95 and remove the skid base. Refer to paragraph 153 and remove the casing and bulkheads from skid cover.

### *c. Cleaning, Inspection, and Repair.*

- (1) Clean the skid base (26, fig. 39) and the skid cover (40, fig. 49) with an approved cleaning solvent and dry thoroughly.
- (2) Inspect base and cover for breaks, cracks, damaged threads, and other damage. Weld minor breaks and cracks. Inspect weld nuts for damaged threads and secure attachment. Weld loose nuts. Replace damaged parts.

*d. Installation.* Install the skid base (para 95). Install casing and bulkheads on skid cover (para 153).

## Section VIII. FUEL TANK

### 169. General

*a.* The fuel tank is secured to the skid cover and is inclosed by the skid base.

*b.* A fuel gage is mounted in the tank next to the fuel tank cap. Connectors mounted in openings in the fuel tank serve as connections for the heater and gasoline engine power unit tube assemblies. A drain plug, in the rear of the tank, is accessible through a cutout in the skid base.

### 170. Fuel Tank

#### *a. Removal.*

- (1) Drain fuel tank and disconnect all tube assemblies.

- (2) Remove fuel tank (para 95).

#### *b. Cleaning, Inspection, and Repair.*

- (1) Clean and inspect the fuel tank as described in paragraph 95.
- (2) If there are any damaged seams, small punctures, or leaks, fill fuel tank with water and weld all damaged spots. Check security of welds supporting tank hangers and repair welds if necessary.
- (3) After repairing, drain water from fuel tank and run cleaning solvent through tank to remove all traces of water and foreign particles.

#### *c. Installation.*

- (1) Install fuel tank (para 95).
- (2) Connect all tube assemblies.

## Section IX. ELECTRIC MOTOR

### 171. General

The bracket mounted electric motor unit issued with the Model BT400-40 heater is a dust-proof, sealed unit and should require only once-a-year maintenance to repack the shaft roller bearings.

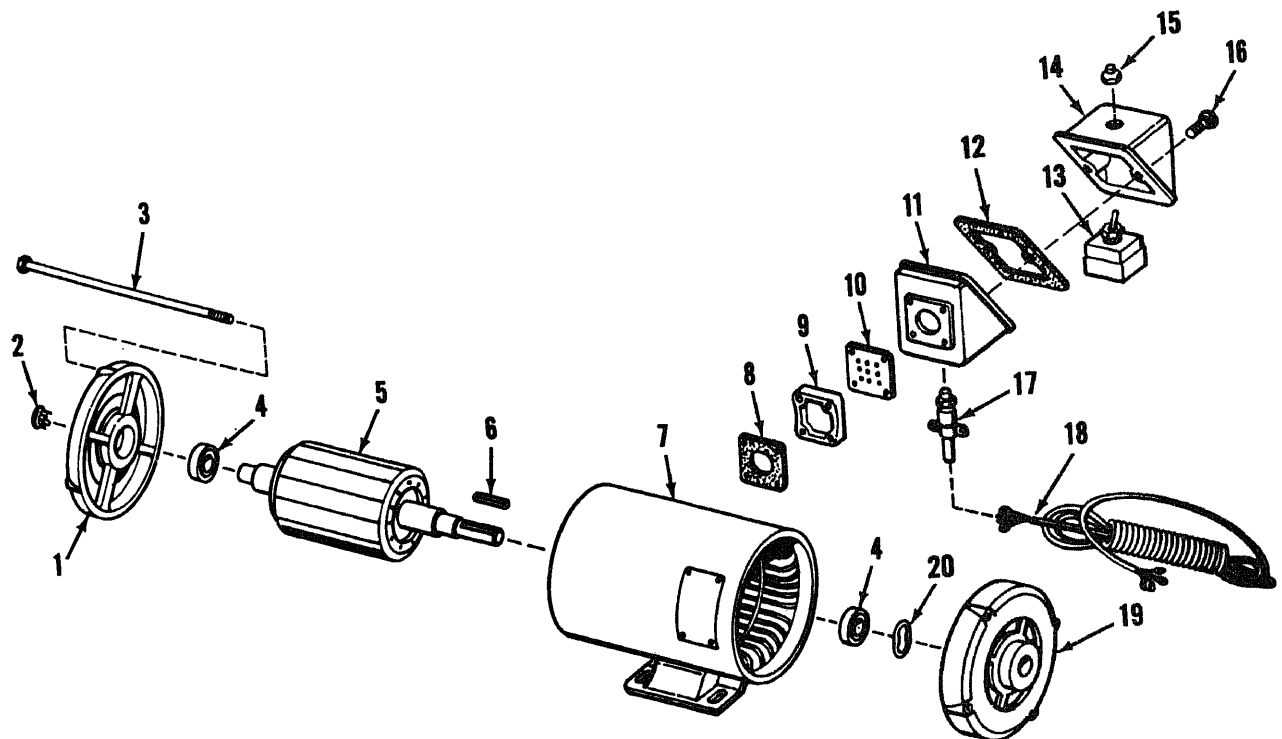
### 172. Electric Motor

#### *a. Removal and Disassembly.*

- (1) Remove the motor from the bracket (para 104).
- (2) Remove the cable (18, fig. 53) and connector (17) (para 106).

- (3) Remove the nuts, lockwashers, and thru bolts (3).
- (4) Remove the cap plug (2) and, using a soft drift, drive the armature shaft (5) with bearings (4) and drive end bell (19) from the housing (7).
- (5) Remove the drive endbell and spring washer (20), and press the bearings (4) from the shaft.
- (6) Remove endbell (1) from the housing.

*b. Inspection and Testing.* Refer to TM 5-764 for inspection, testing, and repair of electric motors. Replace the electric motor housing and stator if the stator is defective.



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- 1 End bell
- 2 Plug, cap
- 3 Bolt, thru
- 4 Ball bearing (2)
- 5 Armature
- 6 Key
- 7 Housing, with stator
- 8 Gasket
- 9 Spacer
- 10 Gasket

- 11 Junction box
- 12 Gasket
- 13 ON-OFF switch
- 14 Cover
- 15 Boot
- 16 Screw, machine, 1/4-20 x 1/2 in. (2)
- 17 Connector, cable
- 18 Cable, electrical
- 19 End bell, drive
- 20 Spring washer

Figure 53. Electric motor, exploded view.

### c. Assembly and Installation.

- (1) Press the bearings (4, fig. 53) on the shaft (5). Make sure the sealed sides of the bearings are toward the armature.
- (2) Aline the locating marks and install the endbell (1) on the housing (7). Install the armature shaft with the rings into the housing and the

- (4) Install the spring washer (20) (cupped side up) and the drive endbell (19) on the shaft. Aline the locating marks and secure the endbell with the thru bolts (3) and the lockwashers and nuts. Install the cap plug (2) in the endbell.
- (5) Install the connector (17) and cable (18) (para 106).
- (6) Install the electric motor on the bracket (para 104).

## APPENDIX I

### REFERENCES

#### A-1. Fire Protection

TB 5-4200-200-10

Hand Portable Fire Extinguishers Approved for Army Users.

#### A-2. Painting

TB ENG 60

Preservation and Painting of Serviceable Corps of Engineer Equipment.

TM 9-213

Painting Instructions for Field Use.

#### A-3. Preventive Maintenance

TB ENG 347

Winterization Techniques for Engineer Equipment.

TM 5-764

Electric Motor and Generator Repair.

TM 5-2805-208-14

Organizational, DS and GS Maintenance Manual (Including Repair Parts and Special Tools Lists), Engine, Gasoline, Military Standard Model 1A08-111, 1 1/2 HP, FSN 2805-068-7510 and Model 2A016-111, 3 HP, FSN 2805-072-4871.

TM 9-207

Operation and Maintenance of Army Materiel in Extreme Cold Weather (0° to -65°F).

TM 38-750

Army Equipment Record Procedure.

#### A-4. Interference Suppression

TM 11-483

Radio Interference Suppression.

#### A-5. Supply Publications

FSC9100-IL

TM 5-4520-208-25P

Petroleum, Petroleum-Base Products, and Related Materials. Organizational, Direct and General Support, and Depot Maintenance Repair Parts and Special Tools, Lists, Heater, Duct Type, Portable, 400-000 BTU/HR Model BT400-40 and BT400-40-1, FSN 4520-792-8257 and FSN 4520-930-9474.



## APPENDIX II

### MAINTENANCE ALLOCATION CHART

#### Section I. INTRODUCTION

##### 1. General

This Appendix contains the explanation of all the maintenance and repair functions authorized the various maintenance levels.

a. Section II, MAC (Maintenance Allocation Chart) designates overall responsibility for the performance of maintenance operation. The implementation of maintenance tasks upon the end item or components will be consistent with the assigned maintenance operations.

b. Section III (Tool and Test Equipment Requirement) contains a list of the special tools and special test equipment required for each maintenance operation as referenced from the MAC Section II Column K. This section cross references a particular maintenance operation on the MAC when special tools and equipment are required to perform a specific maintenance task.

c. Section IV (REMARKS) contains supplemental instructions, explanatory notes and/or illustrations required for a particular maintenance operation. This section is cross referenced to MAC Section II Column L.

##### 2. Maintenance Operations

Maintenance is any action taken to keep material in a serviceable condition or to restore it to serviceability when it is unserviceable. Maintenance of material includes the following:

a. *Inspect.* To determine serviceability of an item by comparing its physical, mechanical and electrical characteristics with established standards.

b. *Test.* To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

c. *Service.* To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents, and air. If it is desired that elements, such as painting and lubricating, be defined separately, they may be so listed.

d. *Adjust.* To rectify to the extent necessary to bring into proper operating range.

e. *Align.* To adjust specified variable element of an item to bring to optimum performance.

f. *Calibrate.* To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy of the instruments being compared with the certified standard.

g. *Install.* To set up for use in an operational environment such as an emplacement, site or vehicle.

h. *Replace.* To replace unserviceable items with serviceable assemblies, subassemblies or parts.

i. *Repair.* To restore an item to serviceable condition. This includes but is not limited to inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

j. *Overhaul.* To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.

k. *Rebuild.* To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using

original manufacturing tolerances and specifications, and subsequent reassembly of the item.

### 3. Explanation of Columns (sec. II)

*a. Sequence Number.* The entries coincide with the sequence of functional grouping followed in the Repair Parts and Special Tool List.

*b. Component Assembly Nomenclature.* This column contains the grouping index heading, subgroups heading, and a brief description of the part starting with the noun name.

*c. Maintenance Operations and Maintenance Levels.* This column contains the various maintenance operations A through J, service, adjust, etc. A symbol indicating the maintenance level placed in the appropriate column in line with an indicated maintenance operation authorizes that level to perform the function. The symbol indicates the lowest level of maintenance responsible for performing the function, but does not necessarily indicate repair parts stockage at that level. Higher levels of maintenance are authorized to perform the indicated functions of lower levels. The symbol designation for the various maintenance levels are as follows:

C—Operator or crew  
O—Organizational  
DS—Direct Support  
GS—General Support  
D—Depot

*d. Reference Note.* This column is subdivided in two columns. Column L references the tool

and test equipment requirements (T and TE) Section III of the MAC. Column M references the remarks Section IV of the MAC.

### 4. Explanation of Columns (sec. III)

*a. Reference Code.* This column consists of a number and a letter separated by a dash. The number references the T and TE requirements column on the MAC. The letter represents the specific maintenance operation the item it is to be used with. The letter is representative of column A through J on the MAC.

*b. Maintenance Level.* This column shows the lowest level of maintenance authorized to use the special tool or test equipment.

*c. Nomenclature.* This column lists the name or identification of the tool or test equipment.

*d. Tool Number.* This column lists the manufacturer's code and part number, or Federal stock number, of tools and test equipment.

### 5. Explanation of Columns (sec. IV)

*a. Reference Code.* This column consists of two letters separated by a dash. The first letter references Column L, the second letter references a maintenance operation, Column A through J on the MAC Section II.

*b. Remarks.* This column lists the remarks and other information pertinent to the operation being performed as indicated on the MAC Section II.

## Section II. MAINTENANCE ALLOCATION CHART

Sequence number	Component assembly nomenclature	Maintenance functions											Note reference	
		A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	L Tools and equipment	M Remarks
1	POWER UNIT GASOLINE ENGINE Engine, Gasoline -----	F	O	C	--	--	--	--	O	H	--	--	----	A
2	FAN ASSEMBLY													
3	MAGNETO (Burner) Magnetos ----- Cable Assembly -----	O O	-- --	-- --	-- --	O --	-- --	-- --	O O	F				

Sequence number	Component assembly nomenclature	Maintenance functions											Note reference	
		A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	L Tools and equipment	M Remarks
4	COMBUSTOR HEAT EXCHANGER AND AIR CONTROL								F	F				
	Combustor Assembly -----	--	--	--	--	--	--	--	F	F				
	Heat Exchanger -----	--	--	O	O	--	--	--	O					
	Igniter, Plug -----	--	--			--	--	--						
5	EXHAUST SYSTEM													
6	FUEL SYSTEM								O	F				
	Fuel Pump (Burner) -----	--	--	O	--	O	--	--	O					
	Fuel Filter -----	--	--	C	--	--	--	--	O					
	Fuel Controls -----	--	--		O	--	--	--	F	F				
	Fuel Tank Assembly -----	--	--	C	--	--	--	--	O					
	Fuel Lines and Fittings -----	O	--	--	--	--	--	--						
7	CABINET TOP													
8	CABINET SIDE PANELS AND BASE													
9	CONTROL BOX (Less Controls)													
10	TRAILER ASSEMBLY													
	Wheel Assembly -----	--	--	O	--	--	--	--		O	O			
	Tire, Tubes -----	C	--	C	--	--	--	--	O					
	Springs -----	--	--	C	--	--	--	--	O					
11	POWER UNIT, ELECTRIC MOTOR													
	Motor Assembly -----	F	F	--	--	--	--	--	O	H				

## Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

Reference code	Maintenance level	Nomenclature	Tool number
		No Special Tools or Test Equipment Required.	

## Section IV. REMARKS

Reference code	Maintenance level	Remarks
A	O	Test of Engine includes operation and compression.

## APPENDIX III

### BASIC ISSUE ITEMS LIST AND OPERATING SUPPLIES

#### Section I. INTRODUCTION

##### 1. Scope

This appendix lists items which accompany the heater, duct type, or are required for installation, operation or operator's maintenance. Section II lists the accessories, tools and publications required for the maintenance and operation by the operator, initially issued or authorized with the equipment. Section III lists the maintenance and operating supplies required for initial operation.

##### 2. Explanation of Columns

The following provides an explanation of columns in the tabular list in Section II.

a. *Source, Maintenance and Recoverability Codes (Col. 1).*

- (1) *Source.* Indicates the selection status and source for the listed item. Source codes are:

Code	Explanation
P	Applied to repair parts which are stocked in or supplied from the GSA/DSA Army supply system and authorized for use at indicated maintenance categories.
M	Applied to repair parts which are not procured or stocked but are to be manufactured at indicated maintenance categories.
X2	Applied to repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain them through cannibalization. If not obtainable through cannibalization, such repair parts will be requisitioned with supporting justification through normal supply channels.

- (2) *Maintenance.* Indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is:

Code	Explanation
O	Organizational Maintenance (Operator/Crew).

- (3) *Recoverability Code.* Indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are:

Code	Explanation
R	Applied to repair parts and assemblies which are economically repairable at DSU and GSU activities and are normally furnished by supply on an exchange basis.
T	Applied to high dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts are normally repaired or overhauled at depot maintenance activities.
U	Applied to repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, high dollar value reuseable casing and castings.

- b. *Federal Stock Number.* Indicates the Federal stock number for the item.

c. *Description.* Indicates the Federal item and any additional description required. A five-digit manufacturer's or other service code is shown in parentheses followed by the manufacturer's part number. Repair parts quantities included in kits, sets and assemblies that differ from the actual quantities included in

kits, sets and assemblies that differ from the actual quantity used in the specific item are listed in parentheses following the repair part name.

d. *Unit of Issue.* Indicates the units used as a basis of issue, e.g., ea, pr, ft, yd, etc.

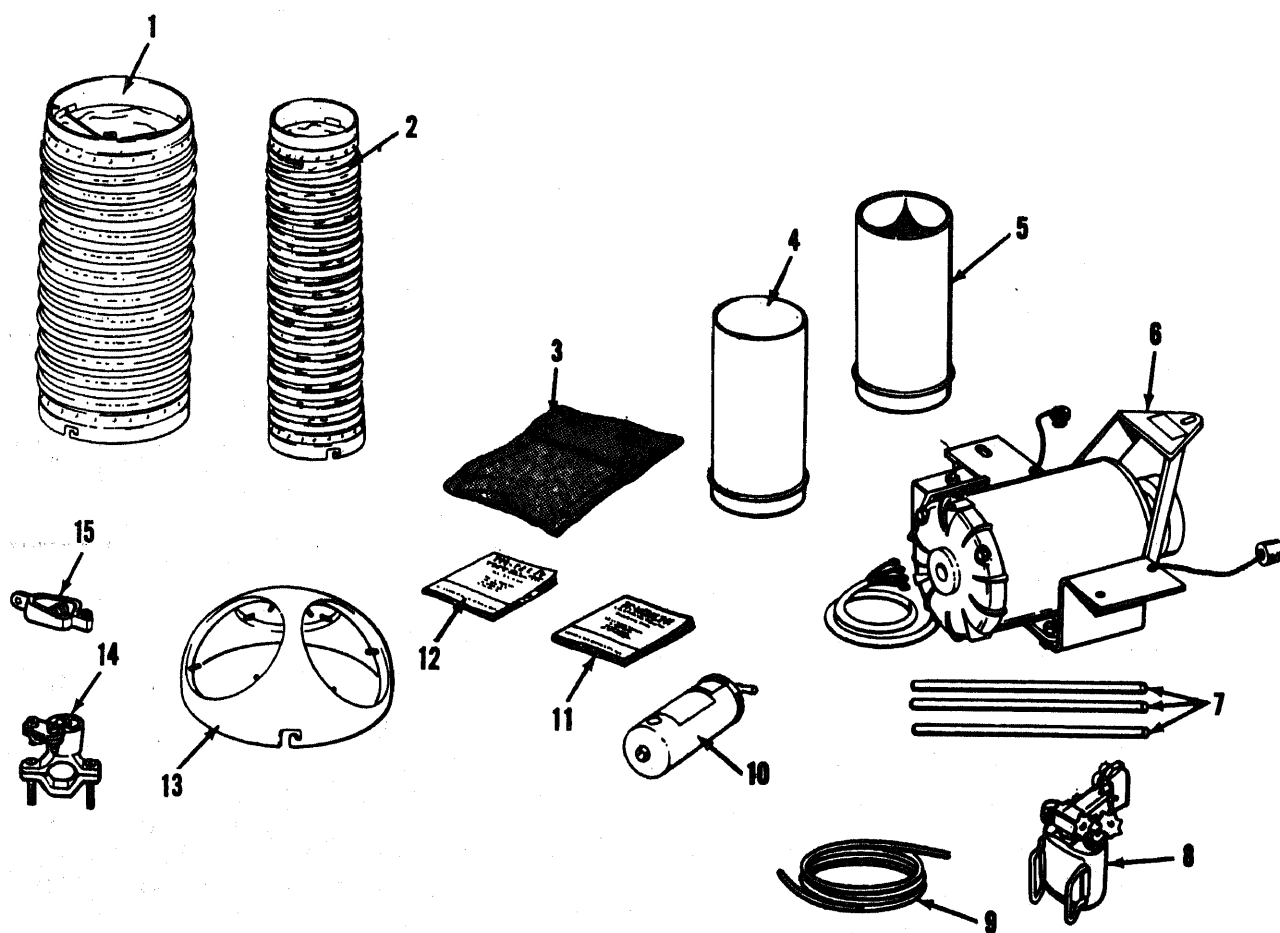
e. *Quantity Incorporated in Unit.* Indicates the quantity of the item used on the equipment.

f. *Quantity Authorized.* Indicates the total quantity of an item required to be on hand

and necessary for operation and maintenance of the equipment. Items to be requisitioned as required are indicated by an asterisk.

g. *Illustration.*

- (1) *Figure Number.* Indicates the figure number of the illustration in which the item is shown.
- (2) *Item or Symbol Number.* Indicates the callout number used to reference the item in the illustration.



MEC 4520-208-15/54

- |                             |   |
|-----------------------------|---|
| 1 Air hose assembly (2)     | 10 Operator, Organizational, Direct and General Support Manual for Engine, Gasoline             |
| 2 Air hose assembly (3)     | 11 Operator, Organizational, Direct and General Support and Depot Maintenance Manual for Heater |
| 3 Publications case         | 12 Duct adapter   |
| 4 Exhaust stack extension   | 13 Ground clamp   |
| 5 Exhaust stack extension   | 14 Electrical clip  |
| 6 Electric motor power unit |   |
| 7 Ground rod (3 sections)   |   |
| 8 Winterization torch       |   |
| 9 Electrical wire (10 ft)   |   |

Figure 54. Basic issue items.

### 3. Explanation of Columns Contained in Section III

a. *Item.* This column contains numerical sequence item numbers assigned to each component application to facilitate reference.

b. *Component Application.* This column identifies the component application of each maintenance or operating supply item.

c. *Federal Stock Number.* The Federal stock number will be shown in this column and will be used for requisitioning purposes.

d. *Description.* This item and a brief description are shown.

e. *Quantity Required for Initial Operation.* This column lists the quantity of each maintenance or operating supply item required for initial operation of the equipment.

f. *Quantity Required for 8 Hours Operation.* Quantities listed represent the estimated re-

quirements for an average eight hours of operation.

### 4. Abbreviations

AWG	-----	American Wire Gage
dia	-----	diameter
ea	-----	each
ft	-----	feet
in.	-----	inch(s)
MIL	-----	Military
No.	-----	Number
Std	-----	Standard
w/	-----	with
w/o	-----	without

### 5. Federal Supply Codes

Code	Manufacturer
82366	Aero Motor Mfg. Co.
83144	Flexible Tubing Corp.
90598	American Air Filter Co., Inc.

## Section II. BASIC ISSUE ITEMS LIST

Source	Source codes		Federal stock number	Description	Unit of issue	Quantity authorized	Quantity issued with equipment	Illustr	
	Maintenance	Recoverability						Figure	Item
				Group 31—Basic Issue Items, Manufacturer Installed					
				3100—Basic Issue Items Manufacturer or Depot Installed					
P	O	--	4520-675-5331	ADAPTER: Duct, 12 in. to 6 in. (83144) FT62	ea	1	1	54	12
P	O	--	7520-559-9618	CASE: Operations and Maintenance Publications, cotton duct, water repellent, mildew resistant	ea	1	1	54	3
P	O	--	4520-930-5973	HOSE ASSEMBLY, AIR: Flexible, 6 in. diameter, 15 ft lg (83144) FT8706	ea	3	3	54	2
P	O	--	4520-930-5974	HOSE ASSEMBLY, AIR: Flexible, 12 in. diameter, 15 ft lg (83144) FT8705	ea	2	2	54	1
P	O	--	-----	PIPE, EXHAUST: w/ screen (90598) TR3355	ea	1	1	54	4
P	O	--	2990-941-5276	PIPE, EXHAUST: w/screen (90598) TR3095	ea	1	1	54	5
P	O	R	-----	POWER UNIT ASSEMBLY: Electric motor, 208-220V, 60 cycle, ac, 3 phase (90598) TMA3018				54	6
				Model BT400-40	ea	1	1		
				Model BT400-40-1	ea	1	1		
				TM 5-2805-208-14	ea	1	1	54	10
				P/Mil Std Engine					
				TM 5-4520-208-15	ea	1	1	54	11
				Heater, Duct Type					

Source	Source codes		Federal stock number	Description	Unit of issue	Quantity authorized	Quantity issued with equipment	Illustr	
	Maintenance	Recoverability						Figure	Item
				Group 82—Basic Issue Items, Troop Installed					
				3200—Basic Issue Items, Troop Installed or Authorized					
P	O	--	5975-243-5861	Clamp, electrical, ground 1/2 in. to 1 in.	ea	1	*	54	13
P	O	--	5935-735-4993	Clip, electrical (82366) 651P10	ea	1	*	54	14
P	O	--	5975-642-8937	Rod, Ground, 9 ft. lg. 5/8 in. dia. cone point, 3 section	ea	1	*	54	7
P	O	--	4940-475-1574	Torch, Winterization	ea	1	*	54	8
P	O	--	6145-189-6695	Wire, electrical, No. 6 AWG	ft	10	*	54	9
P	O	--	4210-889-2221	Extinguisher, Fire; dry chemical, 2 1/2 lb. cap.	ea	1	*	*	*

## Section III. MAINTENANCE AND OPERATING SUPPLIES

Item	Component application	Source of supply	Federal stock number	Description	Quantity required for initial operation	Quantity required for 8 hours operation	Notes
1	0101 Crank-Case	--- KY KY KY KY KY	----- 9150-231-6633 9150-265-9437 9150-231-9037 9150-242-7603 9150-265-9428	OIL, LUBRICATING Grade 9250 or OE-30 Grade 9110 or OES OE-10	2 pt. ----- 2 pt. 2 pt. -----	----- ----- ----- ----- -----	(1) Included in quantity required for 8 hours operation.
2	6007 Tank			FUEL, GASOLINE  MIL-G-5572 or MIL-G-3056 Type I & II	16 gal. (1) -----	36.2 gal. (2)	(2) Quantity required under conditions requiring maximum usage.

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By Order of the Secretary of the Army:

HAROLD K. JOHNSON,  
General, United States Army,  
Chief of Staff.

Official:

KENNETH G. WICKHAM,  
Major General, United States Army,  
The Adjutant General.

Distribution:

*Active Army:*

USASA (2)  
ACSI (1)  
DCSLOG (1)  
CNGB (1)  
TSG (1)  
CofEngrs (3)  
CC-E (1)  
Dir of Trans (1)  
CofSptS (1)  
USAMB (1)  
USA Arty Bd (2)  
USA Armor Bd (2)  
USAIB (2)  
USAAARADB (2)  
USAAESWBD (2)  
USAAVNTBD (2)  
USCONARC (3)  
OS Maj Comd (5) except  
USARJ (1)  
USASETAF (2)  
USAMC (1)  
USACDCEC (10)  
USA Mbl Equip Comd (46)  
MDW (1)  
Armies (2)  
Corps (2)  
USAC (1)  
Div (2)  
Engr Bde (1)  
USMA (2)  
Svc Colleges (2)  
Br Svc Sch (2)  
Gen Dep (10)  
Engr Dep (10)

Army Dep (2) except  
TOAD (3)  
USA Tml Comd (2)  
Army Tml (1)  
Div Engr (2)  
Engr Dist (2)  
Engr Cen (5)  
AMS (3)  
MAAG (1)  
JBUSMC (1)  
Engr FLDMS (2)  
Ft Knox FLDMS (10)  
USACOMZEUR (2)  
Fld Comd, DASA (8)  
USA Engr R&D Lab (3)  
USAREUR Engr Proc Cen (2)  
USAREUR Engr Sup Con Agcy (10)  
Units org under fol TOE:-2 ea. UNOINDC  
1-100  
1-102  
1-258  
5-48  
5-237 (5)  
5-262 (5)  
5-267 (1)  
5-278 (5)  
5-279  
29-41  
29-85  
29-86  
55-57  
55-405  
67  
67-2

NG: None.

USAR: Same as Active Army except allowance is one (1) copy for each unit.

For explanation of abbreviations used, see AR 320-50.